VOL. 67, No. 3 NOVEMBER, 1938

IMPERIAL MYCOLOGICAL
23 MAR 1939
INSTITUTE

THE PHILIPPINE JOURNAL OF SCIENCE

MANILA
BUREAU OF PRINTING
1938

22729

DEPARTMENT OF AGRICULTURE AND COMMERCE

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THE PHILIPPINE JOURNAL OF SCIENCE

Published by the Bureau of Science, Department of Agriculture and Commerce

[Entered at the Post Office at Manila, P. I., as second-class matter.]

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THE PHILIPPINE
JOURNAL OF SCIENCE

VOL. 67 NOVEMBER, 1938 No. 3

PHILIPPINE DIPTEROCARPACEÆ, III

By F. W. FOXWORTHY
Of Berkeley, California

NINE PLATES

Twenty years have passed since the last paper of this series [1] was published. During that time a number of collections, notably the fine series of collections by A. Loher, have been added to those in the herbarium of the Bureau of Science (now the Philippine National Herbarium). There has also been a great deal of study of the group in the Malayan region. It seems appropriate, at this time, to give a recapitulation of the work done and to indicate the present understanding of the Philippine species.

Dr. E. Quisumbing, curator of the Philippine National Herbarium, has kindly made most of the Philippine collections available for this work; and acknowledgment is made to him and to the Philippine Government for the loan of herbarium specimens. Gratitude is also expressed to the herbarium of the University of California, at Berkeley, for aid and provision of a place to do the work.

Published records of work done during the past twenty years are extensive. The list of publications dealing with the Dipterocarpaceæ appended to this paper contains only those of more general application. Other publications are mentioned in the notes about the different species.

A number of articles in publications of the Philippine Bureau of Forestry, the Philippine Bureau of Science, and elsewhere,

[1] Philip. Journ. Sci. § C 13 (1918) 163–200.

have dealt more or less completely with the uses and the distribution of various species. Some of these articles are mentioned in the notes for different species.

This large amount of work has added greatly to our understanding of the distribution of this family and of specific characteristics. It has changed our conception of some species and has made it desirable to reclassify and redescribe many of the forms.

The quantitative importance of the family has often been stressed. The timber has been extensively exploited. The largest part of the timber used in the Islands has been produced by members of this family. The average annual export of timber has, for twenty years, been more than 50,000,000 board feet, most of it dipterocarp. It seems probable that the family will continue to supply most of the timber of the Archipelago.

Merrill's publication called attention to the close relationship of the Philippine Dipterocarpaceæ to those of western Malaysia, and indicated their probable derivation from that region through former land connection with Borneo. Since the publication of his paper one species has been found which is a representative of the eastern Malaysian element. The species is *Vatica papuana* Dyer, which is also found in eastern Borneo, the Moluccas, and New Guinea. The fruits are water-borne, which accounts for the wide distribution of this species. The only other Philippine dipterocarp that shows close relationship to forms of eastern Malaysia is *Anisoptera thurifera* (Blco.) Bl., which seems to be closely related to *A. polyandra* Bl., of New Guinea. All of the other Philippine members of the family seem to be most closely related to forms found in western Malaysia. Fifteen species, which are not endemic, have their extra-Philippine distribution in western Malaysia.

Within the Philippines the distribution of the dipterocarps seems to be conditioned by the distribution of rainfall. Those parts of the Islands with no, or only a very short, dry season, have by far the greatest number of species. The parts that have a distinct dry season have extensive dipterocarp forests, with a relatively small number of species. Only a few species are known exclusively from the regions with a distinct dry season, and these species are represented by but few collections.

Fifty-one species are now recognized as occurring in the Philippines. Five species have been described as new, and additional material has made it possible to complete the de-

scription of eight other species. In no less than 19 of the species it has been impossible to complete the description, for lack of complete material. Seven of these species lack fruit and 12 lack flowering material. Additional collections may cause us to change our notions of some of the species, and it is probable that additional species will be found. A great deal of additional collecting is needed.

Key to the Philippine genera of the Dipterocarpaceæ.

a^1. Calyx urceolate, tnclosing fruit; 2 sepals growing out into long wings. Stamens usually more than 20, anthers long-awned. Style on a large, fleshy stylopodium.
  b^1. Fruit not grown together with calyx, stamens many, styles filamentous; stipules amplexicaul ..... 1. *Dipterocarpus.*
  b^2. Fruit grown together with calyx. Stipules small, fugacious. Stamens 25 to 60; style short..... 2. *Anisoptera.*
a^2. Calyx imbricate in bud, in the ripe fruit usually 2 or 3 lobes larger than the others, developing into long wings. Stamens mostly 15, sometimes many, rarely 10. Appendage to connective usually long-pointed.
  b^1. Long wings not more than 2.
    c^1. Two long wings, appendage to connective long-pointed. Usually a large stylopodium ..... 3. *Hopea.*
    c^2. Lobes of fruiting calyx short, not extending beyond fruit.
      d^1. Calyx lobes not recurved, otherwise as in *Hopea.* 4. *Balanocarpus.*
      d^2. Calyx lobes round and recurved, stamens 30 to 60 (§ 2. *Isoptera*). 6. *Shorea.*
  b^2. Long wings 3 or more.
    c^1. Fruit with 3 long wings.
      d^1. Anthers with 5 pointed projections..... 5. *Pentacme.*
      d^2. Anthers with one projection from the connective, or without projections ..... 6. *Shorea.*
    c^2. Fruit with 5 long wings; calyx in bud almost valvate; no stylopodium ..... 7. *Parashorea.*
a^2. Calyx valvate in bud; fruit usually with 2 long wings. Stamens 15. Anthers short, oval, smooth; appendage to connective blunt. 8. *Vatica.*

1. Genus DIPTEROCARPUS Gaertner, f.

Large trees with long, clear boles and rather thin, light-colored, resinous, scurfy bark.[2] Bark usually less than 2.5 cm

[2] Thick, dark-colored, and deeply fissured bark, such as is found in *D. obtusifolius* Miq. and in other species growing in similar situations, is not found in any of the Philippine species. The thick bark in *D. obtusifolius*, *D. intricatus*, and some other forms in Siam and Burma, seems to be suited to resistance to the frequent ground fires. The Philippine forms all belong to the wet tropical evergreen forest.

thick, gray or light brown, covered with scattered corky pustules, shedding in irregular scroll-work patches; middle bark brownish, more or less fibrous, distinctly brittle; inside of the bark of same pale or yellowish color as sapwood, darkening on exposure to air. The bark contains quantities of fluid resin, which flows out and thickens after a cut. All of the Philippine species seem to have the same type of bark. Stipules large, semiamplexicaul, when falling leaving conspicuous, obliquely-ascending scars completely encircling the twig. Twigs terminated by stipular scales, which are usually large and become very much enlarged and elongated before they are pushed off by the expanding new leaves. These stipular scales may, in some instances, grow to a length of 30 cm or more. They are usually light-colored, sometimes pink, inside, and they are found on the ground in great numbers just after the appearance of new leaves. It seems that their removal involves the formation of a corky layer, which is what renders the stipular scar so prominent and persistent. Leaves coriaceous when mature, seedling leaves membranaceous; usually entire but sometimes retuse or even dentate (as young leaves of *D. grandiflorus*); secondary nerves mostly straight, joined by parallel and reticulate tertiary nerves. In bud, the two halves of the leaf folded upon each other, folds between two secondary nerves, in most species, clearly seen in the mature leaf, in some cases tertiary nerves showing an angle along line of fold. Twigs with outer part of pith containing a large number of resin canals, which are arranged in a circle, or in two concentric circles, and number sometimes as many as 100; the freshly cut twig usually shows the location of these, even without the aid of a lens, by the circle of resin that oozes out. The wood of all species is practically identical in structure; in weight, hardness, and color the differences between various species seem to be no greater than those found within individuals of the same species growing in different places. All species of this genus are locally called *apitong*. A detailed description of the wood has been given by Reyes.[3] Flowers large, in few-flowered racemes which are sometimes branched. Receptacle concave, continued into a campanulate, tubular, or obconical tube, the segments of which are valvate or slightly imbricate in bud, unequal in size, two segments longer. The calyx tube in the flower does not give any indication of the section of the genus to which

[3] Philip. Journ. Sci. 22 (1923) 320–322.

the species belongs; moreover, members of the section *Sphærales* may show as distinctly ridged floral calyces as members of the section *Alati*. Petals at base often cohering, but not connate. Stamens usually many, sometimes only 15, anthers sometimes twisted; valves generally equal, connective prolonged into a long-pointed acumen. Ovary generally hairy, continued into a conical, fleshy stylopodium, terminating in a filiform style and a minute stigma. Tube of fruiting calyx not adnate to fruit, globose or ovoid, smooth or with five ribs or wings alternating with segments and formed by decurrent margins of segments, two of which develop into large membranous or coriaceous wings. Pericarp thin at base, thick and fibrous in upper portion. Mature seed often albuminous, in this case the cotyledons thin, folded, often lobed. When in the mature seed all albumen has been consumed, the cotyledons are intricately folded. The hypocotyl (radicle) is generally short.

Size and form of trees.—All Philippine species are of large size and similar form, and a single characterization will serve for the group. They are very large straight trees with relatively small crowns and a high form factor. From the standpoint of utilization they are the best-shaped trees of the group. Buttresses are small or absent. The total height is often more than 45 m, and trees as high as 55 m are not uncommon. Mature trees are often more than 30 m to the first branch. The average diameter is about 65 cm, and trees with a diameter of 180 cm have been found. The crown is roughly flat conical or irregular, open, and made up of a few large branches. Sapwood is usually present in only small amounts in large trees.

Fruits with more than the normal two long wings have occasionally been found. I have already recorded [4] abnormal fruits for *Dipterocarpus grandiflorus* from Negros and suggested that they might be due to hybridization. Young saplings occasionally have leaves different from those of the mature tree. In a few cases, as already mentioned for *D. grandiflorus*, the sapling leaves are sometimes distinctly dentate. There are also, with some species, normal sapling or seedling leaves very different in size, shape, and texture from those of the mature tree.

Flowering and fruiting.—Flowering time is more constant than in any of the other genera thus far observed. It seems that all species sufficiently observed flower every year. Flowering time may vary for different species and for different

[4] Philip. Journ. Sci. § C 6 (1911) 252, pl. 36.

individuals in the same species; but, within a given locality, certain trees seem to flower at nearly the same time year after year. Flowers are borne in very great profusion. They are light-colored and pleasantly scented, during the short time that they last, often making the whole forest fragrant. Most of the Philippine species have flowers 3 cm or more in diameter. The fruit is ripe in three to five months after the flowers appear and is borne in very great quantity, often almost completely covering the ground near big trees, and some fruits are distributed to a distance of quite a number of meters by the action of the wind. The forest floor is always very moist, and germination takes place within a very few days after the seed reaches the ground. If this were not the case, reproduction would be very difficult, because large numbers of seeds, sometimes the whole crop, are destroyed by insects. Sometimes, probably because of prevailing high humidity, seeds germinate before falling from the tree.

Germination and growth.—Burkill [5] studied in detail the germination of a number of the species occurring in the Malay Peninsula (including *Dipterocarpus grandiflorus* and *D. Kerrii*), and in giving the results of his work at Singapore says: [5]

> The flower of *Dipterocarpus* usually, it seems, faces earthwards; and after flowering is done, the growing fruit maintains the position. When the fruit is ripe it falls as a shuttle-cock to the floor of the forest and there without delay germinates. The embryo, at fruitfall, and if normal, has the placentar cotyledon enwrapped more or less completely by the other, the radicle extruding slightly, from the basal lobes that the cotyledons possess, or just covered by them . . . The apices of the cotyledons in the genus not uncommonly abut against a small lump of resin which acts as ballast when the fruits fall . . . After reaching the ground the radicle is extruded from the apex of the fruit without any well-defined cracks spreading down the fruit-wall; it is thrust out by the elongation of the petioles of the cotyledons, and growing, exhausts the cotyledons of the nutriment stored in them, without the development in them of any visible change. They do not part in any way nor develop chlorophyll. Their elaborate folding is a consequence of their size. Their surfaces, which are morphologically upper surfaces, are very even. *Dipterocarpus* produces after the cotyledons first a pair, and then alternating leaves, the first of the alternating leaves is not crowded on the pair.

All species studied have had the same type of germination; that is, hypogeous, the cotyledons remaining in the seed and not being raised from the ground.

[5] Journ. Roy. Asiat. Soc. Straits Branch.

The leaves formed during the first year's growth are smaller than those of the mature tree. Leaves formed in subsequent years are larger, and saplings of several years' growth may have leaves much larger than those of the mature tree, and usually of thinner texture. Young seedlings often develop a taproot when they are only a few centimeters high. Young plants require a good deal of protection until they are a meter high or higher. The mature tree is very exacting in its demand for light and must get its crown into full light. Tall seedlings and young saplings are able to push their heads up through vegetation at a most surprising rate, so that it is possible to stock fully an area with a much smaller number of seedlings than is necessary with most other forms, and to insure the clean, straight trunk with a high form factor, which means that the relative amount of clear timber per tree is very large. It also accounts for the marked freedom from clinging climbers.

Brown and Matthews [6] have given some growth records for *D. gracilis* and *D. grandiflorus*. Some species may grow more rapidly than these records indicate. There may be a long suppression period after which, however, growth is probably fairly rapid.

Pests.—Growing plants seem to have comparatively few enemies. Insect galls are occasionally found on twigs and leaves, but they are rarely developed enough to do much damage. The most serious attack is on the fruits, and is sometimes severe enough to destroy most of the crop. These attacks seem to be the most serious of limiting factors in the natural regeneration of the species of *Dipterocarpus*. Fungus attack seems to do relatively little damage to living trees, except in the case of hollow heart in overmature trees.

Products.—The wood is much the most important product, and its structure, already mentioned, has been studied in several of the species. Oleoresin, the oil locally called *balau*, is of little present commercial importance. A. P. West and W. H. Brown have given a detailed account of this product.[7]

Common names.—The name *apitong* is applied to *Dipterocarpus grandiflorus* and to certain other species. The wood of different species is not distinguished commercially, and as the

[6] Philippine dipterocarp forests. Philip. Journ. Sci. § A 9 (1914) 413–561.

[7] For. Bur. Bull. 22 2 (1921) 54–66, figs. 15–22.

name *apitong* is applied to all that is exported, it has become fairly generalized for various species of *Dipterocarpus*. *Panao* is the name applied to *D. gracilis* in many places, and also to other forms; *balau* is a variant of this name. *Anahaun, kamuyao, malapaho,* and *pagsahiñgan* are also commonly used names in various places. *Hagakhak* is the name most commonly applied to the forms with hairy leaves that grow in alluvial soil.

Distribution.—Apitong is one of the most abundant Philippine woods, apparently constituting, by volume, as much as 20 per cent of all the timber grown in the Islands. It probably occurs in all the good forests and is found under a wide range of soil conditions. A particular species may be exacting in its demands, but there are species adapted to most of the soil conditions of the Philippines. Some species occur in low flat forest, while certain others are ridge forms. The altitudinal range is from sea level up to about 1,800 meters, but usually below 1,000 meters.

The genus contains about 70 species, and reaches its best development in the Malayan region—Borneo with 31 species, Sumatra with 20, and the Malay Peninsula with 24, having the largest representation.

Of the 11 species now recognized as Philippine, 6 have extra-Philippine distribution, 6 extend to Borneo, 4 to Sumatra, 3 to the Malay Peninsula, and 2 each to lower Burma, lower Siam, and Java. Of the 5 species now classed as endemic, 4 are known only from scanty or incomplete material.

Divisions of the genus.—Fruiting material is essential for specific determination in this group Leaves of practically identical appearance may be found in species belonging to different sections of the genus. The flowers have not ordinarily been found a convenient or reliable basis for specific distinction.

The genus was divided into sections by Dyer on the basis of the form of the fruit and fruiting calyx. This distinction is an arrangement of convenience and may not necessarily indicate natural relationships; but it is the best so far proposed. There is often difference of opinion as to the section in which certain species should be placed. There is a considerable amount of variation, and, while most species fall readily into definite sections, the wide variation or the different degree of development of the fruit may cause difficulty in determining whether a particular form belongs to the *Sphaerales* or the *Tuberculati,* or whether another form belongs to the *Angulati* or to the *Alati.*

Key to the Philippine species of Dipterocarpus.

a 1. Tube of fruiting calyx smooth (§ 1. *Sphærales*).
b 1. Leaves strongly pubescent or tomentose ..... 1. *D. gracilis.*
b 2. Leaves usually glabrous, or not tomentose.
c 1. Leaves small, long-caudate-acuminate ..... 5. *D. caudatus.*
c 2. Leaves not long-caudate-acuminate.
d 1. Fruiting calyx tube turbinate ..... 3. *D. Kerrii.*
d 2. Fruiting calyx tube globose, subglobose, or ellipsoid.
e 1. Leaves with 10 to 12 pairs of nerves, 10 to 20 cm long; fruit 2 cm in diameter ..... 2. *D. Hasseltii.*
e 2. Leaves with 14 to 18 pairs of nerves, 9 to 11 cm long; fruit 1 cm in diameter ..... 4. *D. subalpinus.*
a 2. Tube of fruiting calyx with 5 protuberances on its upper portion (§ 2. *Tuberculati*) ..... 6. *D. Warburgii.*
a 3. Tube of fruiting calyx 5-angular, at least in the upper portion, with more or less conspicuous ridges (§ 3. *Angulati*). 7. *D. basilanicus.*
a 4. Tube of fruiting calyx with 5 wings from top to base or to middle only (§ 4. *Alati*).
b 1. Leaves orbicular or suborbicular ..... 10. *D. orbicularis.*
b 2. Leaves not orbicular or suborbicular.
c 1. Twigs with distinct velvety annuli below stipule scars; fruit woody. 9. *D. speciosus.*
c 2. Twigs without such annuli; fruit not woody.
d 1. Leaves glabrous ..... 8. *D. grandiflorus.*
d 2. Leaves strongly pubescent ..... 11. *D. philippinensis.*

Section 1. Sphærales

Tube of fruiting calyx smooth, globose, oblately spheroidal, conical, or obconical, never angular.

1. DIPTEROCARPUS GRACILIS Blume. **Agan-an (Bicol); anahaun (Bicol, Tag.); apitong (Tag.); balau (Tag., Sul., Chab.); bulai (Tag.); duha (Ibn.); duka (Klng., Cag.); ganan (Bicol); kalusuban (Ilk.); kamuyao (Cag., Ibn.); kurimau (Ibn); lalian (Tag.); lanutan (Neg.); lauaan (Nueva Ecija); lipot (Mbo.); lipus (Vis., Mbo.); malapaho (Tag.); mantolina (Zamb., Sul.); pagsahiñgan (Tag.); palanopang (Tag.) palohap (Sbl.); pamalalian (Cag., Ibn.); pamantulen (Ilk.); pamantuling (Pang.); pamarnisen (Ibn.); panao (Tag., Pang., Sbl., Ibn., Pamp.); patsahiñgan (Tag.); sitam (Ibn.).**

Dipterocarpus gracilis Blume, Bijd. 5 (1825) 224; Fl. Jav. 2 (1828–1829) 20, *pl. 5;* Van Slooten, Bull. Jard. Bot. Buitenz. III 8 (1927) 276.

Mocanera verniciflua Blanco, Fl. Filip. (1837) 451.

Dipterocarpus vernicifluus Blanco, Fl. Filip. ed. 2 (1845) 314; ed. 3 2 (1878) 217, *pl. 183;* Dyer, Journ. Bot. 12 (1874) 104; A. DC. Prodr. 16² (1868) 610; Vidal, Sinopsis Atlas (1883) xiv, *pl. 14, fig. b;* Rev. Pl. Vasc. Filip. (1886) 59; Brandis, Journ. Linn. Soc. Bot. 31 (1895) 31; Merrill, Philip. Journ. Sci. 1 (1906) Suppl. 97; Sp. Blancoanae (1918) 268; Enum. Phil. Fl. Pl. 3 (1923) 91; Merrill & Rolfe, Philip. Journ. Sci. § C 3 (1908) 114; Merritt, Philip. For. Bur. Bull. 8 (1908) 48; Whitford, Philip. Journ. Sci.

§ C 4 (1910) 703; Philip. For. Bur. Bull. 10[2] (1911) 70, *pls, 70, 71;* FOXWORTHY, Philip. Journ. Sci. § C 2 (1907) 391; § C 4 (1909) 514; § C 6 (1911) 248; § C 13 (1918) 177; REYES, Philip. Journ. Sci. 22 (1923) 321, *pl. 12.*

Dipterocarpus fulvus BL., Mus. Bot. 2 (1852) 37.

Anisoptera palembanica MIQ., Fl. Ind. Bat. (1860–1862) 191, 485.

Dipterocarpus lampongus SCHEFF., Nat. Tijdsch. Ned. Ind. 31 (1870) 346.

Dipterocarpus velutinus VIDAL, Rev. Pl. Vasc. Filip. (1886) 59.

Dipterocarpus bancanus BURCK., Ann. Jard. Bot. Buitenz. 6 (1887) 196.

Dipterocarpus Vanderhoevenii KOORD. et Val., Bull. Inst. Bot. Buitenz. 2 (1899) 3.

Shorea mollis BOERL., Cat. Hort. Bog. 2 (1901) 110.

Dipterocarpus gracilis has been very fully described by Van Slooten, and the following is adapted from his work.

All young parts tomentose with small tufts of short hairs intermixed with long ones, pubescence dark-colored, sometimes fugacious. Stipules up to 6 cm long and 6 to 8 mm wide. Leaves ovate to oblong-elliptic, 8 to 15 cm long, 4 to 10 cm wide, usually acuminate at apex, acumen sometimes 1 cm long, rounded at base, upper surface, at any rate when young, covered with long pilose hairs, lower surface tomentose with stellate hairs, brownish when dry; secondary nerves 9 to 16 pairs, curved near the margin and forming more or less conspicuous intramarginal veins, with a number of short intermediate nerves, soon without internerval folds; petioles 2 to 3.5 cm long. Inflorescences simple or branched, 3 to 9-flowered, 3 to 10 cm long; peduncles 1.5 to 4 cm long; bracts stellate, pubescent, oblong-lanceolate, 3 cm long. Flowers light-colored, fragrant, 0.5 to 1 cm apart; bracteoles linear, 15 mm long, 1 to 2 mm wide. Calyx tube subinfundibuliform, very slightly angular, tomentose outside, glabrous inside, about 1 cm long, short-pedicelled; larger calyx lobes linear, up to 1.5 cm long, 2 to 3 mm wide, the smaller ones rotund. Petals obliquely linear-spatulate, obtuse, about 4 cm long. Stamens about 30, 12 to 15 mm long; filaments, anthers, and appendages to connective each 4 to 5 mm long; anthers sagittate at base. Stylopodium ovate, attenuate at top, densely pilose; style 2 cm long, hairy below, glabrous above. Tube of fruiting-calyx subglobose or broadly ovate, rounded at base, sparsely pubescent with stellate hairs, or nearly glabrous, at most 2 cm long and wide; wings oblong-lanceolate, 11 to 15 cm long, 2 to 3.5 cm wide, obtuse or rounded, with slightly recurved margins at base, or flat, often subuni-

nerved, sometimes 3-nerved, lateral nerves then running up to or beyond middle, sparsely pubescent with stellate hairs; smaller wings suborbicular or suboblong, 1 to 1.5 cm long and wide, recurved or concave. Nut oviform, up to 2.5 cm long, 1.5 to 1.75 cm in diameter, narrowed toward apex; densely minutely pubescent with the very base adnate to thin-walled tube of fruiting calyx, top not extending as far as ends of minor lobes.

The species usually occurs in well-drained soil, from sea level up to 800 meters. It seems to be commonest on the sides of ridges and is especially abundant in the regions where the dry season is pronounced.

Most workers on Philippine botany have used Blanco's name, *Dipterocarpus vernicifluus*, for this species. Merrill [8] in 1923 continued to use this name, but indicated that the species was possibly referable to *D. gracilis*. Van Slooten in 1927 showed that the Philippine form belongs to that species, which he gave a very careful description.

The type of Blume's *Dipterocarpus fulvus* was collected by Perottet near Manila in 1819. This is the earliest collection recorded of a dipterocarp species in the Philippines.

Dipterocarpus is widely distributed, from central Sumatra through Java and Borneo to the Philippines. It is one of the most abundant and widely distributed species in the Islands. The most common name for it is *panao*, and its wood is used commercially under the name of *apitong*.

About 125 collections in the herbarium show the following distribution:

LUZON, Cagayan, Isabela, Ilocos Sur, Nueva Vizcaya, Nueva Ecija, Pangasinan, Bulacan, Pampanga, Zambales, Bataan, Rizal, Laguna, Tayabas, Camarines, and Albay Provinces. POLILLO. MARINDUQUE. MINDORO. NEGROS, Negros Occidental Province. MINDANAO, Surigao, Davao, Cotabato, and Zamboanga Provinces. PALAWAN.

2. **DIPTEROCARPUS HASSELTII Blume. Apitong, balao (Pal.); alakak, oladan (Tagb.).**

Dipterocarpus Hasseltii BLUME, Fl. Jav. 2 (1828–1829) 22, *pl. 6;* KORTHALS, Verh. Nat. Ges. Bot. ("Kruidkunde") (1839–1842) 65; MIQUEL, Fl. Ind. Bat. 1[2] (1859) 497; Annales 3 (1867) 85; A. DC., Prodr. 16[2] (1868) 609; BURCK., Ann. Jard. Bot. Buitenz. 6 (1887) 196; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 30; KOORDERS and VALETON, Bijd. v. Booms. Java (1900) 109; KOORDERS, Exk.

[8] Loc. cit.

Fl. 2 (1912) 620; F. BAKER, in Forbes's Mal. Pl. Journ. Bot. 62 (1924) 10; CRAIB, Fl. Siam. Enum. 1 (1925) 135; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 280.

Dipterocarpus quinquegona BL., Mus. Bot. 2 (1852) 36.

Dipterocarpus pentagona A. DC., Prodr. 16² (1868) 610.

Dipterocarpus balsamifera BL., Mus. Bot. 2 (1852) 37.

Dipterocarpus balsamifera KOORDERS and VALETON, Bijd. v. Booms. Java (1900) 111.

Dipterocarpus trinervis Auct. non Bl., FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 247; § C 13 (1918) 177; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 91.

Description adapted from Van Slooten: All vegetative parts entirely glabrous, underside of leaves often excepted. Stipules up to 12 cm long, 1 cm wide. Leaves of adult tree ovate or ovate-elliptic, 14 to 20 cm long, 8 to 12 cm wide, obtuse, upper surface at first clothed with long, adpressed, shining hairs, soon glabrous, lower surface on nerves very sparsely covered with a fine pubescence, whether or not intermixed with thin tufts of long, adpressed hairs, often entirely glabrous, repand, with 10 to 12 pairs of nerves, curved near margin, preserving for a long time internerval folds; leaves of sapling oblong-lanceolate, 25 to 32 cm long, 9 to 12 cm wide, acuminate, acumen blunt, 1 to 1.5 cm long, with about 20 pairs of nerves; petioles slender, glabrous, 3 to 5 cm long. Inflorescences simple or rarely branching, often very slender, 5- to 8-flowered, short ones 2- to 4-flowered, 8 to 15 cm long; peduncles 2.5 to 3.5 cm long; bracts of inflorescence up to 6 cm long, rather membranaceous; bracts of flowers a few mm long, base very wide. Flowers 1.5 to 2.5 cm apart, yellowish white, rose-colored inside, fragrant. Calyx tube campanulate-obconic, 11 to 13 mm long, glabrous outside except on margin, lower half of inner side glabrous, upper half densely covered by minute tufts of fine hairs, like both sides of calyx lobes; calyx lobes at base 5 to 6 mm wide, longer ones 1.5 to 2 cm, shorter ones 2 mm long. Petals 5.5 to 6.5 cm long, 1 to 1.5 cm wide. Stamens 30, 15 to 18 mm long; filaments, anthers, and prolonged connectives 5 to 6 mm long. Stylopodium oviform, narrowed into style, densely pubescent; style 15 mm long, upper third glabrous, for the rest pubescent like stylopodium. Tube of fruiting calyx subglobose or slightly pyriform, glabrous, marked by brownish points, 2 to 2.5 cm long, 2.5 cm wide, strongly constricted at top, forming a narrow neck 5 to 10 mm high. Accrescent calyx lobes linear-oblong to obovate-lanceolate, 12 to 20 cm long, 2.5 to 4 cm wide, obtuse or rounded, sprinkled with minute tufts of short hairs or gla-

brous, with 3 principal nerves usually running up to top and 2 lateral nerves ramified close to base; minor lobes rotund, 1.33 to 2 cm long, 1 to 1.33 cm wide. Nut ovate or conic when dry, diameter 2 cm, from the very base attenuate towards the acute top, densely covered with tawny shiny pubescence, slightly or not at all exceeding mouth of calyx tube.

TYPE: *Van Hasselt,* in H. L. B. *sub No. 902, 146-210* and *146-211,* in H. A. R. T. *sub. No. 72499,* collected in Java in 1823.

Dipterocarpus Hasseltii is found in lowland forest, usually below 500 m.

Van Slooten, after careful study of the type and extensive collections from the Netherlands Indies, prepared a careful description of the species. It is apparent, as he has indicated, that we who have worked on the group in the Philippines have misinterpreted the species. He has indicated the following collections from Palawan as belonging here: *Elmer 13172,* and *For. Bur. 29194 Cenabre* and *29107 Cenabre.* It is evident that *For Bur. 12272 Wallace, 27863 Cenabre, Gellidon & Paras,* and *30138 Cenabre & Ablasa,* all from Palawan, also belong here. Besides these, *For. Bur. 10195 Curran,* from Tayabas Province, and *13573 Meyer & Foxworthy* from Negros, are referred here with doubt, as they are sterile specimens. Thus the only Philippine distribution of this species that can be determined with certainty is Palawan. Some of this material was formerly, mistakenly, referred to *Dipterocarpus trinervis,* a species which seems not to occur in the Philippines. All of the Philippine material that has been referred to *D. trinervis* belongs to *D. Hasseltii;* the Philippine material formerly credited by me to *D. Hasseltii* must be placed in other species.

Dipterocarpus Hasseltii has a rather wide distribution and is recorded from Java, the Malay Peninsula, Sumatra, and Borneo.

2. DIPTEROCARPUS KERRII King. **Apitong, panao, palsahiñgan.**

Dipterocarpus Kerrii KING, Journ. Asiat. Soc. Bengal 62[2] (1893) 93; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 28; RIDLEY, Fl. Mal. Penin. 1 (1922) 215; CRAIB, Fl. Siam. Enum. 1 (1925) 136; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 295; BURKILL, Journ. Str. Br. R. As. Soc. 81 (1920) 55; PARKER, Ind. For. Rec. 16[1] (1931) 15, *pl. 10;* FOXWORTHY, Mal. For. Rec. 10 (1932) 69.

Dipterocarpus obconicus FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 1951; Philip. Journ. Sci. § C 13 (1918) 178; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 90; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 299.

Dipterocarpus perturbinatus FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 177.

Dipterocarpus cuneatus FOXWORTHY, Philip. Journ. Sci. § C **13** (1918) 178; MERRILL, Enum. Philip. Fl. Pl. **3** (1923) 89.

Description as given by King:

All parts, except the petals, glabrous; young branches thin, slightly flattened at the tips. Buds narrow, cylindric. Leaves coriaceous, ovate-elliptic, acute or very shortly and bluntly acuminate, the edges undulate, the base cuneate; main nerves 8 to 11 pairs, oblique, straight, bold, and shining on the lower surface; length 7.5–10 cm., breadth 5–6.3 cm., petiole 2–3 cm. Panicles short, spreading, few-flowered. Flowers 3.8 cm. long. Calyx-tube glaucous. Petals linear-oblong, obtuse, more or less pubescent or tomentose towards their middle externally. Fruit turbinate, smooth, 2.5–3.8 cm. in diam.; accrescent calyx-lobes linear-oblong blunt, reticulate, 3-nerved, 11–12.5 cm. long and 32–38 mm. broad; minor lobes very short, broad, rounded.

TYPE: specimens collected in Malacca: *Maingay 199; Griffith 727; Derry 1032.*

A large tree of lowland forest, from sea level up to 400 m altitude or more, often growing on the slopes of ridges.

Dipterocarpus Kerrii is distinguished from *D. Hasseltii* by the turbinate fruit and the smaller leaves, which are usually cuneate at the base and have less distinct internerval folds. There is variation in size and shape of fruits and leaves, and large-fruited forms may be almost indistinguishable from *D. Hasseltii*. *D. Kerrii* and *D. Hasseltii* have often been confused, and Brandis recorded the specimen collected by Derry (*1032*) under *D. Hasseltii*, although it was one of the numbers cited by King with the original description of this species.

Mr. Symington, examining the Philippine material, noted that the material classified under *D. cuneatus*, *D. obconicus*, and *D. perturbinatus* seemed to belong to this species; and, I believe that this view is correct.

The following Philippine collections seem to belong here: LUZON, Cagayan Province, *Bur. Sci. 78239 Edaño:* Nueva Ecija Province, *For. Bur. 22145 Alvarez;* Laguna Province *For. Bur. 10105 Curran, 19261 Curran:* Tayabas Province, *For. Bur. 3223 Hagger, 12500 Rosenbluth, 28341* (type of *D. perturbinatus* Foxworthy in the Philippine National Herbarium), *28361 Mabésa:* Camarines Province, *For. Bur. 21469* (type of *D. cuneatus* Foxworthy in the Philippine National Herbarium), *21703 Miránda:* Albay Province, *Cuming 881.* MINDORO, *Bur. Sci. 40873 Ramos.* SAMAR, *For. Bur. 25933 Cortez.* MINDANAO, Agusan Province, *Elmer 13498* (type of *D. obconicus* Foxworthy in the Philippine National Herbarium): Davao Province, *For. Bur. 27705 Angeles and Seloris.*

Some of the above material had previously been credited by me to *D. Hasseltii* and some to other species now reduced to synonymy.

The species, as at present understood, occurs from Burma and peninsular Siam, through the Malay Peninsula and Sumatra to the Philippines.

4. DIPTEROCARPUS SUBALPINUS Foxworthy.

Dipterocarpus subalpinus FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 950; Philip. Journ. Sci. § C 13 (1918) 177.

Large tree. Leaves coriaceous, elliptic-oblong, acuminate, base subcuneate or rounded, glabrous except for scattered stellate hairs along midrib above and along secondary nerves beneath, 4 to 11 cm long, 2.7 to 7 cm broad; secondary nerves 14 to 16 pairs; petiole 15 to 22 mm long. Flowers unknown. Fruit about 9 to 13 mm in diameter and 9 to 13 mm tall; long calyx wings 8.5 to 12 cm long and 14 to 22 mm wide; short wings erect or only slightly recurved, 7 to 8 mm long, 6 to 9 mm wide.

MINDANAO, Agusan Province, Cabadbaran, Mount Urdaneta, *Elmer 13931* (type in the Philippine National Herbarium), August, 1912.

The collector's field notes state:

> Leaves chartaceous, conduplicate on the upper much deeper green and lucid side, much paler beneath; infrutescence axillary or lateral, few inches long, the zigzag yellowish green subpendent stalks few-branched; fruits pendant, the nut portion subglaucous green, their calyx lobes reddish margined; the 2 ruber to purpureus ears only slightly curved, the exserted or apical portion of the seed yellowish.

Dipterocarpus subalpinus is found at from sea level up to an altitude of over 300 m.

Dipterocarpus subalpinus, D. Hasseltii and *D. gracilis* are very closely related. *D. gracilis* and *D. subalpinus* have the same kind of fruit; *D. Hasseltii* and *D. subalpinus* agree in having glabrous, or nearly glabrous, buds. The leaves of *D. subalpinus* are generally smaller than those of *D. gracilis,* and the number of secondary nerves is usually greater than in *D. Hasseltii.* The three short wings of the fruit of *D. subalpinus* are also shorter than is the case in *D. Hasseltii,* and are not expanded or reflexed as is usually the case in that species. Merrill[9] reduced this form to synonymy with *D. Hasseltii,* an arrangement which is not correct, for the reasons given above.

[9] Tom. cit., p. 90.

Dipterocarpus subalpinus is known only from the Philippines and is represented by the following collections:

LUZON, Cagayan Province, *For. Bur. 16947, 17211, 17780 Curran:* Ilocos Norte Province, *For Bur. 13922, 13925–13927, Merritt and Darling:* Nueva Viscaya Province, *For. Bur. 28507 Cenabre in part:* Laguna Province, *For. Bur. 15348 Tamesis:* Tayabas Province, *For. Bur. 31274 Arizabal:* Camarines Province, *For Bur. 21718 Peñas, Soriano and Cebellanosa.* LEYTE, *Bur. Sci. 12739 Rosenbluth.* BILIRAN, *Bur Sci. 18487 McGregor.* MINDANAO, Zamboanga Province, *For. Bur. 22007, 23837 Villamil, 22761 Nave.* A number of collections are not recorded here because of incomplete material.

5. DIPTEROCARPUS CAUDATUS Foxworthy. Apitong.

Dipterocarpus caudatus FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 177; § C 6 (1911) 250; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 89; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 302, 303.

Large tree. Leaves long caudate-acuminate, glabrous, elliptic, cuneate at base, 9 to 13 cm long, 2.5 to 5 cm wide, secondary nerves about 10 pairs; the long-caudate acumen about 1.5 cm long. Petiole 1.1 to 1.5 cm long. Stipules linear, ferruginous-pilose. Fruit globose.

LUZON, Camarines Province, Bo. Hibatac, *For. Bur. 21193 Alvarez* (type in the Philippine National Herbarium), March 28, 1914.

The material consists of leaves and very old and very young fruits picked up from the ground under the tree. It is too incomplete to permit of detailed description of the fruit. The long-caudate, small leaves remain the characteristic feature.

Said to occur on ridges at from 200 to 600 meters above sea level.

The three collections listed with the original description were from Camarines and Albay Provinces. No further material of this imperfectly known species has been collected, and its complete description will have to wait until better material is available.

Section 2. TUBERCULATI

Tube of fruiting calyx with 5 protuberances in the upper portion.

6. DIPTEROCARPUS WARBURGII Brandis. Hagakhak.

Dipterocarpus Warburgii BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 32; FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 1952; Philip. Journ.

Sci. § C 13 (1918) 178; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 91; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 305.

Dipterocarpus pilosus Auct. non Roxb.; F.-VILL., Noviss. App. (1880) 20; VIDAL, Synopsis Atlas (1883) xv, *pl. 14, fig. c;* FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 244, *pl. 34;* § C 13 (1918) 176.

Dipterocarpus affinis BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 31; VIDAL, Synopsis Atlas (1883) *pl. 4, fig. d;* WHITFORD, Philip. For. Bur. Bull. 10[2] (1911) 70, *pls. 72, 73;* FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 246, *pl. 35;* § C 13 (1918) 176; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 88.

Dipterocarpus lasiopodus PERKINS, Frag. Fl. Philip. (1904) 22; MERRILL, Govt. Lab. Publ. 29 (1905) 30; Enum. Philip. Fl. Pl. 3 (1923) 90; REYES, Philip. Journ. Sci. 22 (1923) 322, *pl. 13.*

Dipterocarpus caudifera MERRILL, Philip. Journ. Sci. 29 (1926) 398; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 302.

Dipterocarpus macrorhina VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 300.

Dipterocarpus Woodii MERRILL, Philip. Journ. Sci. 29 (1926) 398; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 303.

The most complete description is given by Van Slooten and is as follows:

Buds, young *branches, petioles, peduncles* and lowest parts of the axes of inflorescences densely covered with long, coarse, spreading or adpressed reddish brown but sordidescent tufted hairs. *Stipules* up to 24 cm. long. *Leaves* ovate, ovate-oblong or oblong-elliptic, 20–25 cm. long, 8–12 cm. wide, obtuse or acuminate, the acumen ½–1 cm. long, rounded or (sub) cordate at the base, repand, both sides glabrous, the lower surface clothed with long adpressed hairs along the midrib and 20–25 pairs of slightly prominent nerves, which originate rather close (± 1 cm.) to each other and are curved near the margin, without forming intramarginal veins, the internerval folds finally disappearing; *leaves* of sapling (± 2 m. in height) 40–50 cm. long, 14–16 cm. wide, nerves in 28–32 pairs, acumen 2–3 cm. long; *petioles* robust, 3–5 cm. long, glabrescent, in *sapling* 1½–2 cm. long. *Calyx-tube* narrowly campanulate, subcylindric, entirely glabrous as are the larger lobes, the latter being 2 cm. long, ± 3 mm. wide in bud. *Petals* yellowish green tomentose in bud when dry. *Infrutescences* simple, bearing 6–7 fruits, 10–15 cm. long; the axes robust, glabrous or the lower parts coarsely hairy as are the peduncles, which are 2–4 cm. long; the fruits placed 2–3 cm. from each other. Tube of the *fruiting-calyx* variously shaped; oviform, subglobose or obovate, the upper portion with or without small obtuse rounded protuberances (the hollows being filled up and the fruit becoming nearly spherical often a long time before the fruit ripens, in which case only a trace of the tubercles remains), with a narrow neck formed by the bases of the lobes, glabrous, 3–4 cm. long, 2½–3 cm. wide; accrescent calyx-lobes obovate-lanceolate or lanceolate, obtuse, constricted at the rounded base, with 3 principal nerves running up to the very top, glabrous, 14–15 cm. long, 3–5, cm. wide; minor lobes rotundate, folded, ½–1 cm. long. *Nut* oviform, ± 3 cm. long, tapering towards the top, at the base broadly rounded, covered with a fine tawny pubescence

in the upper half, for the rest glabrous, with the very base adnate to the tube and with the apex equalling the ends of the minor lobes or overtopping these by ½–1 cm.

TYPE: *Warburg 14431,* from Davao Province, Mindanao.

I formerly thought that this form belonged to *Dipterocarpus pilosus* Roxb., a very imperfectly known species, which, as shown by the work of Parker,[10] seems not to be this species. This leaves *D. Warburgii* as the first adequately described form. *D. lasiopodus* Perkins is plainly the same species. *D. affinis* Brandis, described without fruit, seems to be the same, although the leaves are described as submembranous. I believe that the leaves so described were from an immature specimen, and that it comes within the range of variability of this species. Collections which I referred to *D. affinis* have fruit of a type representative of § *Tuberculati. D. caudifera, D. macrorhina,* and *D. Woodii* are reduced to synonomy on the basis of the comments by Van Slooten.[11]

The fruit, as indicated in the description, shows considerable variability in the amount of development of the tubercles, and it is sometimes difficult to determine the section of the genus to which it belongs. The pubescence, on twigs and petioles, is the heaviest found in any of the Philippine members of the family.

The tree grows to a large size and is gregarious. It is found from sea level (in one case it is recorded as being in black sand on the upper part of the beach) up to an altitude of about 300 m. It is usually on the flat land of stream valleys or on the lower slopes of ridges. It is perhaps most often found on alluvial soil, usually in tolerably well-drained situations. A few collections were said to have been made from limestone hills, and one was recorded as from swampy land. It often forms the bulk of the stand where it occurs.

A species of the nonseasonal part of the islands, recorded from:

LUZON, Cagayan, Isabela, Nueva Ecija, Rizal, Tayabas, and Camarines Provinces. MARINDUQUE. MINDORO. NEGROS, Occidental Negros Province. PANAY, Capiz and Iloilo Provinces. LEYTE. SAMAR. MINDANAO, Agusan, Surigao, Davao and Zamboanga Provinces. BASILAN.

Also widely distributed in Borneo.

[10] Indian Forest Records XVI 1 (1931).

[11] Tom. cit., p. 302, footnote.

Section 3. ANGULATI

Tube of fruiting calyx pentangular.

7. **DIPTEROCARPUS BASILANICUS** Foxworthy. **Apitong.**

Dipterocarpus basilanicus FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 179; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 88.

A tree 40 to 60 m tall and up to 130 cm in diameter. Leaves and twigs finer than in most Philippine species. Leaves chartaceous, elliptic, with acuminate apex and cuneate base; underside of leaves and young twigs pubescent. Terminal buds clothed with long, pilose, silky hairs. Secondary nerves 13 to 15 pairs. Leaves 6 to 11 cm long, 2 to 5.5 cm wide. Fruit 5-angled, 15 to 18 mm long and of about the same diameter. Angles of fruit more or less distinctly developed into wings, but thick and hard. Long wings of fruiting calyx 8 to 9 cm long, 1.5 to 2 cm wide, oblong-elliptic, with 3 distinct longitudinal nerves.

BASILAN, Mount Basilan, *For. Bur. 18895 Miranda* (type in the Philippine National Herbarium), August 28, 1912, at an elevation of 500 to 600 m. The wood is said to be harder than in most other Philippine species and to be used for general construction. Other collections seem to indicate that this is a lowland form. It is known with certainty only from Basilan. A sterile specimen, *For. Bur. 25962 Cortes,* from Samar, may belong here, but it cannot be definitely determined from the material available.

Dipterocarpus basilanicus differs from *D. fagineus* Vesque, of the Malay Peninsula and Borneo, in having slightly smaller fruits, which are more sharply angled, and in the more scantily developed venation of the fruit wings.

Tube of fruiting calyx with 5 straight wings.

Section 4. ALATI

Tube of fruiting calyx with 5 straight wings.

8. **DIPTEROCARPUS GRANDIFLORUS** Blanco. **Apitong (Tag.); kanyin (Burm.); mai yang (Siam.); keruing (Mal.).**

Dipterocarpus grandiflorus BLANCO, Fl. Filip. ed. 2 (1845) 314; ed. 3 2 (1878) 218, *pl. 263;* FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 251, *pl. 36;* § C 13 (1918) 179; Mal. For. Rec. 10 (1932) 87; MERRILL, Bibl. Enum. Born. Pl. (1921) 398; Enum. Philip. Fl. Pl. 3 (1923) 89; RIDLEY, Fl. Mal. Penin. 1 (1922) 216; REYES, Philip. Journ. Sci. 22 (1923) 321, *pl. 11;* VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 333; CRAIB, Fl. Siam. Enum. 1 (1925) 134.

Mocanera grandiflora BLCO., Fl. Filip. (1837) 451.

Dipterocarpus Blancoi BLUME, Mus. Bot. 2 (1852) 35.

Anisoptera ? TURCZ., Bull. Soc. Nat. Moscou 31[1] (1858) 233.
Dipterocarpus Motleyanus HOOKER f., Trans. Linn. Soc. 23 (1860) 159.
Dipterocarpus Griffithii MIQUEL, Ann. 1 (1863–1864) 213.
Dipterocarpus pterygocalyx SCHEFF., Nat. Tijdschr. Ned. Ind. 31 (1870) 347.

Buds covered with a dense indumentum of very minute stellate, light-brown or grayish hairs; stipular bud scales greatly elongated before dropping. Branches and petioles usually glabrous and blackish when dry, or tawny pubescent and glabrescent. Leaves ovate or ovate-elliptic, elliptic when young, 15 to 38 cm long, 8 to 18 cm wide, rounded, subcordate or cordate at base, attenuate towards rounded obtuse or obtusely acuminate top, entire or obscurely repand-crenate, both sides glabrous, with 12 to 20 pairs of nerves, flat; petioles very long, 5 to 9 cm. Inflorescences very slender, glabrous, up to 26 cm long, often bifurcate, 2- to 5-flowered when simple; peduncle 4 to 8.5 cm long; flowers large, placed at distances of 3.5 to 6 cm from each other. Calyx 5-winged from base to apex. Petals up to 7.5 cm long. Stamens 30. Tube of the fruiting calyx oblong, 5 to 6 cm long, wings stout, usually 1.5 to 2, rarely 3 cm wide; accrescent calyx lobes oblong, obtuse, glabrous, 3-nerved, the 2 lateral principal nerves differing in length in different specimens, 14 to 25 cm long, 3.5 to 5.5 cm wide; smaller lobes suborbicular, 1.5 to 2 cm in diameter.

Though very variable in many respects (pubescence of buds and young branches, size of fruits and of leaves), this species is well characterized by the shape of its leaves, its long petioles, very slender, few-flowered inflorescences, and by the size and shape of its fruits, which are among the largest in the genus.

Usually a tree of low hills and ridges up to 600 m above sea level. Usually gregarious, often constituting a considerable part of the volume of the forest. The flowers, which are usually borne in dry weather, are very conspicuous and fragrant, and scent the whole forest when they expand. They are white or cream-colored, with a rosy tinge inside, on the lower part of the petals. Fruit is borne in very great quantity, and a very large part of it germinates.

Abnormalities of fruit and leaves are found where this form occurs with *D. speciosus*, as in Negros; it is believed that natural hybridization is taking place.

A good deal of oleoresin is found in the wood of this species, which is the principal source of the oil known as *balau*.

Dipterocarpus grandiflorus seems to be the most widely distributed species of the family, being found from the Andaman Islands and the Mergui Archipelago, through lower Burma, Siam, the Malay Peninsula, and the Netherlands Indies (except Java and the eastern part), to the Philippine Islands. This range is included between 20° north latitude and 7° south latitude, and between 105° and 125° east longitude.

As in Blanco's other species, no type specimen exists; but the species is very well known, and characteristic specimens may be found in most of the larger herbaria.

Recorded distribution in the Philippines (*fide* Merrill) is: LUZON, in all provinces between Cagayan and Sorsogon. MINDORO. PALAWAN. SIBUYAN. BILIRAN. PANAY. NEGROS. SAMAR. MINDANAO, Agusan and Misamis Provinces.

9. DIPTEROCARPUS SPECIOSUS Brandis. Anahauon (Bicol); apitong (Bicol, P. Bis., Sulu); balau (Ilk.); hagakhak (Ibn., Tag.); panalsalan (Bicol).

Dipterocarpus speciosus BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 38; FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 250, *pl. 37;* § C 13 (1918) 178; PERKINS, Fragm. Fl. Philip. (1904) 22; WHITFORD, Philip. Bur. For. Bull. 10[2] (1911) 70; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 90.

Young branchlets covered with long, fasciculate, fuscous, stellate hairs. Leaves chartaceous, short-petiolate, oblong-elliptic, with scattered, very short stellate hairs on the midrib beneath, 15 to 27.5 cm long; petiole 18 mm long; secondary nerves 18 pairs; tertiary nerves parallel and reticulate. Flowers unknown. Fruit turbinate, with 5 thick rigid wings.

BASILAN, *Vidal 2160* (*type*).

Our material has petioles longer than those described for the species; but the petioles of *D. grandiflorus* and related forms seem to show considerable variation in length. Brandis says, "Differs from *D. grandiflorus* in the short petioles, the tomentum of long hairs on young shoots, and the thick, not membranous, edge of the fruit-wings."

The thick edge of the fruit wings is the most striking feature. There is a considerable range of variation from an exceedingly heavy and woody fruit where the wings are reduced to ridges, to a condition where the wings are almost as membranous as in *D. grandiflorus.* The species can be placed in either *Angulati* or *Alati,* according to the texture of the ridges or wings of the fruit. It is usually placed in the latter section.

Where these two species occur in the same locality there seem to be intergrades; and it is believed that natural hybridization takes place.

There are usually broad, tawny annuli below the stipule scars. This feature has heretofore been considered peculiar to *D. Kunstleri* King; C. F. Symington, who has examined the Philippine material, places it under that species, which has heretofore been known from the Malay Peninsula, Sumatra, and Bangka. The two may be identical, in which case *D. Kunstleri* would be the preferred name; but I do not make the reduction, because none of the Philippine collections are in flower, and the large flowers of *D. Kunstleri* are so distinct that flowering material is needed before reduction can safely be made.

A number of the collections have leaves bearing some resemblance to those of *D. Warburgii*, and further collections will be needed to determine the limits of the two species.

Distribution in the Philippines:

LUZON, Cagayan, Isabela, Tayabas, and Albay Provinces. POLILLO. NEGROS. SAMAR. BASILAN. Most of the collections are rather incomplete, and it may be necessary to change our notions of the distribution when more complete material is available.

10. DIPTEROCARPUS ORBICULARIS Foxworthy.

Dipterocarpus orbicularis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 180; MERRILL, Enum. Phil. Fl. Pl. 3 (1923) 90; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1927) 266, 324.

A large tree with brownish tomentum on twigs, petioles, and underside of leaves. Leaves mostly suborbicular, some obovate, 9 to 22 cm long, 6 to 11 cm wide, with crenulate margins; apex shortly and very bluntly acuminate; base rounded or cuneate; secondary nerves 9 to 12 pairs; tertiary nerves parallel and reticulate; petioles 2.5 to 3.5 cm long. Twigs, buds, petioles, and margins of leaves densely covered with long pilose hairs; upper side of leaf glabrous, except for a few scattered hairs along veins; lower surface very thickly covered with large stellate hairs, many of which are along the tertiary nerves; secondary nerves and midrib for the most part, clothed, with pilose hairs and uniting near margin with a fine intramarginal vein of almost the same size as the tertiary nerves and united with them. Van Slooten mentions that there is, "a very long, slender inflorescence and broadly winged calyx tubes. Fruit (immature) with membranous wings as in *D. grandiflorus*."

LUZON, Camarines Sur Province, Lagonoy, *For. Bur. 21719 Peñas, Soriano, and Abellanosa* (type in the Philippine National Herbarium), April 26, 1914. The species is known only from imperfect material from Camarines and from British North Borneo. It is most closely related to *D. conferta* V. Sl., of Borneo, and *D. rotundifolia* Foxw. and *D. concava* Foxw., of the Malay Peninsula. It differs from the first by its fewer-nerved leaves, laxer inflorescence, and definitely winged fruit; from *D. rotundifolia* by its pubescent leaves and winged fruit; and from *D. concava* by its flat leaves and pilose pubescence.

11. DIPTEROCARPUS PHILIPPINENSIS Foxworthy. Ayamban (Ilk.).

Dipterocarpus philippinensis FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 253, *pl. 38;* § C 13 (1918) 179; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 90.

A large tree, 30 m tall and 75 cm in diameter. Fruit winged, leaves similar to those of *D. gracilis.* Mature leaf (picked up under tree) 19 cm long, 11 to 12 cm wide, ovate-lanceolate, acute, entire, base truncate; secondary nerves 18 pairs; tertiary nerves parallel, reticulate, with stellate hairs; petiole 5 cm long. Young shoots and seedling leaves ferruginous hairy, exceedingly like the same parts in *D. gracilis.* Fruits much the size and shape of that of *D. marginatus,* but more constricted at the top and with ridges produced into membranous wings, as in *D. grandiflorus.* Fruit 3 to 3.5 cm long, 2 to 2.5 cm in diameter, the two long wings 15 to 17 cm long, 25 to 28 mm wide.

LUZON, Bataan Province, Limay, *For. Bur. 12395 Merritt & Curran* (type in the Philippine National Herbarium), August 27, 1908. The type consists of three mature fruits, two young seedlings, and one adult leaf, picked up under the parent tree. As always where the material is picked under the tree, there is question of the accuracy of the diagnosis, although in this case the collectors are known to be very careful.

The species was again collected in Abra Province, Luzon, in April, 1919, *For. Bur. 27444 Gonzales.* As before, the material consists of fruit and leaves picked up under the tree.

2. Genus ANISOPTERA Korthals

Always large trees, with good clear length of bole and distinct buttresses. Young shoots, inflorescences, and underside of leaves clothed with tufts of stellate hairs and minute round scales varying in color from yellow to cinnamon brown; scales may be few, in these cases the leaf appears to be almost or

quite glabrous, unless examined with a lens. Stipules small, early deciduous. Flowers in much-branched, axillary and terminal, many-flowered panicles, racemes not unilateral; bracteoles early deciduous. Calyx lobes usually imbricate and unequal, 2 of them obtuse, the 3 others acute. Petals usually twisted in bud, membranaceous, many-nerved, outside minutely hairy on parts which are uncovered in bud. Stamens 25 to 50, in 2 to 3 whorls, glabrous in all parts, usually persistent in fruit; anthers unequal, one pair of cells much smaller than the other pair; connective prolonged into a long awn, as long as or longer than anther and filament together. Ovary half, or more than half, sunken in receptacle, with well-developed, fleshy, persistent stylopodium that is crowned by 3 short styles which cohere closely, without well-differentiated stigmas. Fruiting calyx tube adnate to and nearly enclosing fruit; the 2 large segments flat at base, with 3 prominent longitudinal nerves; the 3 small segments 1- to 3-nerved. Cotyledons very evidently unequal.

Bark.—Bark light or dark gray, sometimes with a brownish tinge, shallowly and irregularly longitudinally fissured, shedding in irregular thin pieces. Bark thick, sometimes 18 to 22 mm, made up of a number of alternating yellow and white layers, the former hard and fibrous, the latter soft. Inside of bark yellow, like the sapwood. Surface with numerous corky pustules. Trees in the open may be very light-colored, while those in dense forest may, on a wet day, appear to be almost black.

Wood.—Sapwood and heartwood distinct, the former very pale yellow or whitish, the latter yellow. The wood of all species is practically identical in structure and appearance, and is known in the market by the name of *palosapis*. The description of the wood, taken from Schneider [12] is as follows:

Wood soft and light to moderately hard and moderately heavy, sp. gr. 0.39 to 0.59; sapwood 5–10 cm. thick, staining to dirty grey or brown in drying; heartwood yellowish with rose-colored streaks and blotches or evenly rose-colored; when seasoned, the color is pale yellow with reddish or light yellowish brown markings; slightly disagreeable odor when fresh; grain somewhat crossed; texture coarse; does not check much, but is liable to warp if not carefully seasoned; easy to work, but sometimes cutting roughly on the saw. Not durable in contact with the ground. Subject to insect attack and rots quickly when placed in a wet situation. Makes good planks and has proved to be satisfactory in the manufacture of cupboards. A temporary construction timber. Pith rays numerous, very fine and moderately wide to wide, the latter very conspicuous; pores medium to large,

[12] Philip. For. Bur. Bull. 14 (1916) 162.

numerous, very evenly scattered; resin-canals rarely forming rings, resin content almost white; soft tissue conspicuous, forming minute dots and lines between the rays. The resin-canals often contain fluid resin which sometimes causes the freshly cut surface to be distinctly sticky.

Flowering and fruiting.—Flowers small, yellow or whitish, fragrant, borne in great quantity, lasting but for a short time. Apparently two or three months elapse from the first appearance of the flowers until the fruit is ripe; however, our observations as to the length of the flowering and fruiting times are scanty. Collections seem to indicate that flowers are usually borne in the latter part of the dry season.

Deciduous habit.—Whitford [13] states, "Trees in very dry situations may become entirely destitute of leaves for a few days."

Germination and growth.—Cotyledons very unequal, spreading horizontally on germination. Germination epigeous. First four leaves whorled; fifth leaf and all that follow alternate. First formed leaves smaller than those of mature tree. Saplings may have leaves larger and more acuminate than those of mature tree. Growth of seedlings seems to be slow.

The tree seems to have its best development where there is a distinct dry season; however, certain species do well in the nonseasonal part of the Philippines.

Pests.—Fruits very often destroyed by insects. Timber very subject to decay in wet places and to attacks of termites. Sapwood subject to attacks of shot-hole borers.

Products.—The wood is the principal product of this tree; its structure and uses have already been considered. The resin is of poor quality, relatively scanty in amount, and not used commercially. A certain amount of oleoresin is found in the sapwood, but is not used commercially.

Common names.—The wood of all of our species is known as *palosapis* or *mayapis*. The tree names are given with the descriptions of the different species.

Distribution.—Usually trees of lowland forest, and none of the Philippine species have been found at elevations of more than 750 meters. They are usually of scattered occurrence, ranking tenth in abundance of trees, and making up about 1.5 per cent of the volume of Philippine forests.

The genus seems to contain 12 to 15 species, distributed from Burma to New Guinea. It now seems that all of the Philippine species are endemic, although they are closely related to certain species of the Malayan region.

[13] Philip. Bur. For. Bull. 10 [2] (1911) 77.

Key to the Philippine species of Anisoptera.

a^1. Leaves green on both sides.
  b^1. Leaves 11.5 to 14.5 by 5.7 to 7 cm, with about 20 pairs of secondary nerves; flower clusters erect; flowers white; petals oblong or ovate; stamens 25 to 30 ..... 1. *A. mindanensis.*
  b^2. Leaves usually smaller; flower clusters drooping; flowers yellow; petals lanceolate; stamens about 50..... 2. *A. thurifera.*
a^2. Leaves of different color above and below.
  b^1. Leaves brown; stylopodium terete..... 3. *A. brunnea.*
  b^2. Leaves golden yellow beneath; stylopodium sulcate..... 4. *A. aurea.*

1. ANISOPTERA MINDANENSIS Foxworthy. Palosapis (Zamb.).

Anisoptera mindanensis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 181; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 92.

A large tree. Leaves glabrous or nearly so, chartaceous, oblong-elliptic, 5.7 to 7 cm wide, 11.5 to 14.5 cm long; secondary nerves about 20 pairs, in lower half of leaf a number of short intermediate nerves; tertiary nerves very prominent, reticulate; secondary nerves anastomosing near slightly inrolled margin; petiole 18 to 20 mm long. Inflorescences paniculate, apparently terminal and erect, 17 to 18 cm long; peduncle and branches of inflorescence pubescent or tomentose, with scattered tufts of stellate hairs. Flowers spreading, about 1.5 cm in diameter, white, on stellate-pubescent pedicels 1 to 2 mm long. Sepals apparently all of same size, valvate, lanceolate, acute, covered outside with stellate tomentum, pubescent inside, 3 to 4 mm long and 1.5 to 2 mm wide at base. Petals broadly oblong or obovate, rounded at apex, glabrous, thin, up to 10 mm long and 6 mm wide, with 6 to 7 principal, branched, longitudinal nerves. Stamens about 25; filaments 0.3 to 0.4 mm long; anthers ellipsoid, one pair about 0.3 to 0.4 mm long, the other pair about 0.6 mm long; appendage to connective 1.5 to 2.5 mm long. Ovary sunken in receptacle; stylopodium large, almost cylindrical, deeply sulcate, pubescent, somewhat constricted just above base, 3.5 mm long, 1.5 mm in diameter at base, tapering at top and crowned by three slender styles, each about 0.4 mm long; stigmas minute. Fruit unknown.

MINDANAO, Zamboanga Province, Naganaga, *For. Bur. 21899 Villamil* (type in the Philippine National Herbarium), May 19, 1914. There were three other collections from the same section.

When the original description was published, I referred *For. Bur. 25937,* from Samar, to this species; but that collection consisted only of sterile material, and I now believe that it should have been referred to *A. thurifera.*

There have been, during the past twenty years, no further collections of this species of which the fruit is still unknown.

This species is distinct from other Philippine species by reason of its large, very distinctly veined leaves, its erect flowers, clusters, large white flowers, the oblong or obovate petals, the relatively small number of stamens, and the long, distinctly sulcate, stylopodium.

2. **ANISOPTERA THURIFERA** (Blanco) Blume. **Mayapis, palosapis, palohapi, dagang (S. E. Luzon).**

Anisoptera thurifera (Blanco) Blume, Mus. Bot. Ludg.-Bat. 2 (1852) 42; Vidal, Synopsis Atlas XV, *t. 14, fig. e;* Brandis, Journ. Linn. Soc. Bot. 31 (1895) 44; Merrill & Rolfe, Philip. Journ. Sci. § C 3 (1908) 115; Brandis & Gilg in Engler & Prantl, Nat. Pflanzenfam. 3[6] (1895) 258; Merritt, Philip. Bur. For. Bull. 8 (1908) 48; Whitford, Philip. Journ. Sci. § C 4 (1910) 703; Philip. Bur. For. Bull. 10[2] (1911) 78, *pls. 82, 83;* Foxworthy, Philip. Journ. Sci. § C 6 (1911) 256; § C 13 (1918) 181; Merrill, Sp. Blancoanae (1918) 269; Enum. Philip. Fl. Pl. 3 (1923) 92; Reyes, Philip. Journ. Sci. 22 (1923) 323, *pl. 14;* Van Slooten, Bull. Jard. Bot. Buitenz. III 8 (1926) 4; Symington, S. S. Gard. Bull. 8 (1934) 18, *pl. 4, fig. c.*

Mocanera thurifera Blanco, Fl. Filip. (1837) 446.

Mocanera mayapis Blanco, Fl. Filip. (1837) 449.

Dipterocarpus thurifer Blanco, Fl. Filip. ed. 2 (1845) 310; ed. 3 2 (1878) 212, *t. 264.*

Dipterocarpus mayapis Blanco, Fl. Filip. ed. 2 (1845) 212, 310; DC. Prodr. 16[2] (1868) 610; Dyer, Journ. Bot. 12 (1874) 108; Brandis, Journ. Linn. Soc. Bot. 31 (1895) 40.

Shorea mayapis Blume, Mus. Bot. Ludg.-Bat. 2 (1852) 33.

Antherotriche lanceolata Turcz., Bull. Soc. Nat. Mosc. 19[2] (1846) 505; Walp., Ann. 1 (1848) 113.

Anisoptera lanceolata Walp. *ex* DC. Prodr. 16[2] (1868) 616; Vidal, Phan. Cuming Philip. (1885) 97; F.-Vill., Noviss. App. (1880) 20.

Anisoptera oblonga F.-Vill., Noviss. App. (1880) 20; Vidal, Rev. Pl. Vasc. Philip. (1886) 60, *non* Dyer.

Anisoptera vidaliana Brandis, Journ. Linn. Soc. Bot. 31 (1895) 44; Perk., Frag. Fl. Philip. (1904) 23; Merrill, Philip. Journ. Sci. 1 Suppl. (1906) 97.

Anisoptera tomentosa Brandis, Journ. Linn. Soc. Bot. 31 (1895) 45.

Anisoptera calophylla Perk., Frag. Fl. Philip. (1904) 22.

Large trees with clean straight boles and distinct buttresses. Bark thick, coarsely fissured, dark gray to almost black, pustulate; inner bark with alternate layers of hard and soft tissue, yellow. Leaves varying in texture from thinly chartaceous to coriaceous, green on both surfaces; elliptic, shortly acuminate, on long petioles; clothed below with fine round scales, which may be remote or closely crowded; secondary and tertiary nerves sometimes irregularly scurfy, large, branched stellate hairs often

present along nerves, but their occurrence apparently very irregular; blade 8 to 13 cm long, 4 to 7 cm wide; petioles 3 to 4 cm long; secondary nerves 10 to 16 (or sometimes even 20) pairs, alternating with shorter intermediate nerves; tertiary nerves parallel, reticulate; sapling leaves narrower, long-acuminate. inflorescences axillary, terminal, drooping, up to 20 cm long; peduncle and branches tomentose, with scattered tufts of stellate hairs. Flowers yellow and fragrant, about 1.5 cm across when fully open; buds acuminate, about 7 to 8 mm long; pedicels about 2 mm long, tomentose, with tufts of stellate hairs. Sepals lanceolate, acute or obtuse, the 2 longer sepals about 2 mm long and obtuse at apex, the 3 smaller sepals about 1.5 mm long, acute at apex, tomentose outside with stellate hairs, pubescent inside, 0.5 to 0.6 mm wide at base. Petals spreading in anthesis, lanceolate, recurved at apex, twisted in bud, part exposed in bud pubescent, the rest glabrous, 8 to 9 mm long, 2 to 2.5 mm wide, with about 15 principal longitudinal nerves. Stamens about 50; filaments scarcely widened at base, 0.1 to 0.3 mm long; anthers ellipsoid, one pair twice as long as the other, 0.2 to 0.4 mm long, about 0.2 mm wide; appendage to connective filamentous, up to 1.5 mm long. Ovary partly sunken in receptacle, pubescent or tomentose, hemispherical, about 1 mm in diameter, 0.6 to 0.7 mm high, surmounted by the pubescent or tomentose stylopodium which is campanulate, about 1.5 mm high and 0.6 mm in diameter, narrowed to about 0.3 mm above ovary, narrowed above into the 3 pubescent styles which are 0.2 to 0.3 mm long, usually closely appressed; stigmas minute. Fruit globose, not much constricted at top, 4 to 15 mm in diameter; 2 long fruiting calyx wings 5 to 9 cm long, about 1 cm broad, with 3 prominent longitudinal nerves and numerous, more or less oblique, transverse nerves; the 3 short wings linear or linear-oblong, 2 to 3 cm long, 2 to 3 mm wide.

A tree of frequent, but scattered, occurrence in the lowland forest up to 600 to 750 m above sea level.

I formerly credited this species with a distribution into the Malay Peninsula and north to Burma, because *A. glabra* Kurz [= *A. scaphula* (Roxb.) Pierre] was believed to be a synonym. Symington [14] has shown this to be a mistake, and it now seems that *A. thurifera* is found only in the Philippines. Van Slooten [15] indicated that it is very close to *A. polyandra* Bl., of New Guinea, from which it differs in the rather larger

[14] Tom. cit., p. 4. [15] Tom. cit., p. 16.

leaves with more nerves, the greater number of stamens, and the form of the stylopodium.

The species has not been well understood; descriptions have been incomplete, and the older published illustrations were not entirely representative. Blanco's descriptions were not accompanied by herbarium material, so there is no type specimen. The first published illustration of the flower was in the 3d edition of the Flora Filipinas, published in 1878, plate 264, under the name *Dipterocarpus thurifer*. This plate does not show the characteristic forms of the ovary, stylopodium, and styles, and the number and forms of the stamens are not well shown. Vidal's illustration shows only the fruit. Brandis [16] shows a flower with the ovary cut open. This figure shows the stamens in three series; but the form of the ovary and stylopodium is not well represented and the styles (6) are more prominent than in the material that I have examined. Whitford's illustrations show the bark, leaves, and immature fruit. Recently (1934) Symington published excellent detailed drawings of the flowers. His drawings were made from the flowers of *For. Bur. 707*, a number which was not sent me for this work. My description was made from *Loher 5600*, collected in Rizal Province, Luzon, in May, 1904. There is a difference of opinion as to the number of styles, from 3 to 6 having been recorded. Symington says: "each style is readily divisible into two, a condition found in all the species of *Anisoptera* I have examined."

This is the commonest Philippine species of *Anisoptera* and is very widely distributed in the Archipelago. More than 150 collections in the Bureau of Science collection show the following distribution:

LUZON, Cagayan, Ilocos Norte, Ilocos Sur, Nueva Vizcaya, Abra, Nueva Ecija, Tarlac, Pangasinan, Bulacan, Zambales, Bataan, Rizal, Laguna, Camarines, and Albay Provinces. SIBUYAN. TICAO. MINDORO. PANAY, Capiz Province. NEGROS, Negros Occidental Province. MASBATE. BOHOL. CEBU. SAMAR. MINDANAO, Zamboanga Province.

This species is usually in flower in April, May, or June; but one collection of flowering material was made in October. Fruit has been found from June to April. It seems that flowers are usually borne during the dry season.

[16] Tom. cit., pl. 2, fig. 28.

In previous papers [17] I mentioned a form from Bataan Province that seemed to be intermediate between *A. thurifera* and *A. Curtisii* and had rather small leaves that were yellowish on the underside. It was represented by *For. Bur. 1377, 1381, 1390, 1407, 1792, 12921, 12923,* and *17515.* All of these were from the same locality, and most of them had immature fruit. Later collections, in flower, seem to indicate that these forms belong to *A. thurifera* and are within the natural range of variation of the species.

3. ANISOPTERA BRUNNEA Foxworthy. Afu.

Anisoptera brunnea FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 254, *pl. 40;* § C 13 (1918) 181; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 92.

Large trees. Leaves coriaceous, glabrous and dark green above, chocolate brown and pubescent or tomentose beneath, elliptic or oblanceolate, more or less blunt or rounded at apex and base, with margins slightly inrolled, 6 to 19 cm long, 3.5 to 9.7 cm wide, 12 to 17 pairs of secondary nerves, with intermediate shorter nerves joining the reticulate tertiary nerves, some of the nerves more or less uniting to form intramarginal veins; petioles 2 to 4.5 cm long, rather slender, thickened in upper fourth of their length. Inflorescences axillary or terminal, 7 to 15 cm long, suberect or drooping, rather sparsely flowered, peduncle and branches tomentose, with scattered stellate hairs. Flowers said to be yellow; mature bud acuminate, 7 to 8 mm long; expanded flower 1.5 cm in diameter; pedicels about 2.5 mm long, tomentose. Sepals, the 2 longer ones oblong, rounded at apex, 2.5 mm long, 1.5 mm wide at base, the 3 shorter sepals lanceolate-acuminate, 2 mm long and 1 mm wide at base, all tomentose on outside. Petals ovate, obtuse, 7 mm long, 2.5 to 3 mm wide, with 10 or more faint longitudinal nerves, pubescent or puberulous outside, glabrous within. Stamens about 40; filaments 0.2 to 0.3 mm long; anthers oblong, 0.4 to 0.6 mm long; appendage to connective filiform, 1 to 1.5 mm long. Ovary partly sunken in receptacle, constricted above, tomentose; stylopodium subcylindrical, tomentose, 1.5 mm high, 1 mm in diameter; styles pubescent, about 0.3 mm long; stigmas minute. Fruit globose, 1 to 1.5 cm in diameter, scurfy, dark brown. The two long wings somewhat pubescent, 5 to 8 cm long, 6 to 10 mm wide, with three or four principal nerves

[17] Philip. Journ. Sci. § C 6 (1911) 258; § C 13 (1918) 181.

and numerous secondary nerves, which are transverse or oblique and reticulate. The 3 short wings linear, 1- to 3-nerved, somewhat scurfy, like the fruit.

LUZON, Cagayan Province, Camalamugan, *For. Bur. 11292 Klemme* (type in the Philippine National Herbarium), April 26, 1908. The type was in fruit and the original description did not give an account of the flower, although one collection of flowering material was referred to it. The flowers were not described because the collection, *For. Bur. 13128*, had rather larger leaves than the type. Consideration of other collections has convinced me that there is a considerable range of variation in the leaves; therefore, the original description has been modified and the description of the flowers added. The flowers were described from *For. Bur. 12995*, collected in Cagayan Province in July, 1911.

This species differs from *A. thurifera* in the brown color of the underside of the leaves, the rather larger, globular fruit, the broader petals, the less dense flower clusters, and the rather stouter twigs.

It has been found principally in northern Luzon, in Cagayan and Ilocos Norte Provinces. A single collection from the Babuyanes Islands and one from Samar are also credited to this species.

4. ANISOPTERA AUREA Foxworthy sp. nov. Plates 1 and 2. Dugong, manapo, malahapi; dagang (Laguna, S. E. Luzon).

A. Curtisii FOXWORTHY, *non* Dyer, Philip. Journ. Sci. § C 6 (1911) 255; § C 13 (1918) 181; WHITFORD, Philip. For. Bur. Bull. 10[2] (1911) 78, *pl. 41;* MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 92; REYES, Philip. Journ. Sci. 22 (1923) 324, *pl. 15;* VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 8 (1926) 11; SYMINGTON, Gard. Bull. S. S. 8 (1934) 17.

A large tree, up to 40 m high and 1 m or more in diameter, crown conspicuous because of color of under side of leaves. Branchlets rather stout, densely clothed with a golden-yellow tomentum. Leaves oblong or elliptic, or sometimes obovate, narrowed to both ends, apex acute or shortly acuminate, base rounded, 7 to 15 cm long and 3 to 6 cm wide, glabrous and dark green above, with deeply depressed midrib, golden yellow beneath; secondary nerves 18 to 20 pairs, conspicuously looped toward margin, with occasional short intermediate veins, reticulations visible on both surfaces; petioles rugulose, scabrous, squamate, 2.5 to 3.5 cm long. Inflorescence terminal or axillary,

15 to 20 cm long, with numerous short branches, tomentose with numerous scattered tufts of stellate hairs, of same color as petioles and under side of leaves. Flowers greenish or whitish, fragrant, on 2 to 2.5 mm long tomentose pedicels. Sepals apparently valvate, of same length, lanceolate, tomentose outside and pubescent within, margins inrolled, about 3 mm long and 1.5 mm wide at base, bluntly acute at apex. Petals slightly twisted in bud, lanceolate, glabrous except where exposed in bud, 9 to 10 mm long, 2 to 2.3 mm wide at base, with 8 to 10 longitudinal nerves. Stamens about 40, attached to base of petals and along notched margin of gynœcium, persisting in fruit; filaments 0.2 to 0.3 mm long, slightly flattened at base; anthers of unequal size, one pair twice as long as the other, 0.2 to 0.6 mm long; appendage to connective filiform, 1 to 1.5 mm long. Ovary broad, rather flat, partly immersed in receptacle, tomentose, with edge indented where filaments occur, constricted above and surmounted by a rather keg-shaped tomentose stylopodium, which is sulcate and crowned by 4 to 5 spreading styles; stigmas minute; ovary about 1.2 mm in diameter, constricted portion about 0.5 mm in diameter; thickest part of stylopodium about 0.8 mm in diameter; styles 0.3 to 0.4 mm long, glabrous; total height of gynœcium about 2.5 mm. Fruit stalk 3 to 4 mm long, tomentose, with tufts of stellate hairs; calyx tube campanulate, adnate to $\frac{1}{2}$ to $\frac{2}{3}$ of the nut, about 6 to 8 mm in diameter, 8 to 10 mm high, tomentose when young; 2 large calyx lobes linear-spatulate, 8 to 12 cm long, 1 to 1.5 cm wide, pubescent when young, with scattered stellate hairs; 3 small lobes linear, acute, pubescent or tomentose, up to 3 cm long, 2 to 3 mm wide; nut tomentose, about $\frac{2}{3}$ enclosed in calyx cup, globular, about 1 cm in diameter, surmounted by part of stylopodium and styles.

LUZON, Tayabas Province, near Kabibihan, *For. Bur. 28359 Mabesa* (type of flowering specimen in the Philippine National Herbarium), June 6, 1918. The fruit was described from *For. Bur. 10700*, collected by H. M. Curran, in Camarines Province, Luzon, June, 1908.

Formerly, having only fruiting material, I considered this to be *A. Curtisii*, a Malayan species which it very much resembles; but Van Slooten and Symington have both expressed doubt as to the correctness of that identification. Additional material is now available and shows certain differences. I have now described it as a new species, the specific name having refer-

ence to the color of the underside of the leaves, the most conspicuous feature when the tree is seen in the field.

A. aurea is usually a tree of ridge forest, at from 100 to 600 m above sea level, and is known only from the part of the Archipelago having a nonseasonal climate.

The following collections are referred here:

LUZON, Laguna Province, *Bur. Sci. 8985,* in fruit (this specimen was not sent me), *For. Bur. 15353,* with fallen fruit and leaves: Tayabas Province, *For. Bur. 25654,* in flower, June, 1916; *31435,* in fruit, August, 1931; Camarines Province, *For. Bur. 10700,* in fruit, June, 1908; *12809, 13358,* in fruit, July 1909; *18723, 21128, 21233, 21725, 30480,* flower and fruit, July, 1927; *30479,* fruit, July 1927. POLILLO, *For. Bur. 3218,* fruit, July, 1905; *26253, 31429,* in fruit, July, 1931.

3. Genus HOPEA Roxburgh

Receptacle flat or slightly convex, bearing on its margin 5 imbricate calyx lobes. Stamens usually 15, regularly alternating in 3 whorls, the 5 outer and 5 inner standing opposite each other and alternating with the petals, the 5 of the middle row episepalous. Anther cells of equal length. Filaments broadened towards base, connective prolonged into a long awn. Styles of most species on a large fleshy stylopodium that, like the ovary, is smooth or only slightly hairy. In a small number of species there is no distinct stylopodium, and in these cases the style is usually long-filamentous, often with a circle of hairs at the base. The two outer lobes of fruiting calyx developed into long wings. Pericarp thin-walled. Seed-coat very delicate. Hypocotyl long, half as long, often as long as seed, point of attachment of cotyledons therefore in middle or at base of seed. Cotyledons thick, fleshy, deeply 2-lobed, mostly unequal, placentar cotyledon usually surrounded by the other. Cells of cotyledons usually filled with starch.

Large or medium-sized trees, some species growing gregariously, heartwood yellowish brown. Leaves usually coriaceous and smooth, stipules usually small and fugaceous. Flowers sessile or short-stalked, in 1-sided racemes, these joined in axillary or terminal panicles. In some species calyx and branches of inflorescence smooth, in others thickly hairy.

Bark thin or rather thick, smooth or longitudinally fissured. Dark-colored pyramids of bast fibers always distinct in inner part of bark. There is never any large development of scleren-

chyma layers as in *Anisoptera* and some species of *Shorea*. The inside of the bark is usually yellow and darkens on exposure to the air. There is often a pale greenish or olive line at the junction of wood and bark.

The species of this genus are usually trees of medium or large size, although they do not reach the proportions of the large species of *Dipterocarpus* and *Shorea*, and their boles show a greater amount of taper.

Flowering and fruiting.—None of our species are known to have a regular fruiting period, although it is believed that all, or nearly all, fruit at tolerably frequent intervals. Fruiting appears to be local rather than general.

Distribution.—The members of this genus are much less abundant than some of the species of *Dipterocarpus* and *Shorea*, and have a more scattered occurrence. They may be gregarious to the extent of small groups at rather large intervals. None of the species are found very high in the mountains, although certain forms are common on ridges below 800 meters. Some species are characteristically found on low flat ground or along streams.

The genus comprises about 60 species, distributed throughout most of the range of the family, about as follows: Ceylon 3; India 5; Burma 4; Siam 5; Indo-China 5; Malay Peninsula 16; Sumatra 9; Java 2; Borneo 19; Celebes 1; Philippines 7. All the Philippine species are endemic.

Key to the Philippine species of Hopea.

a^1. Secondary nerves few and prominent.
  b^1. Leaves oblong, unilaterally unsymmetrical.
    c^1. Leaves 10 to 15 cm long, 2.2 to 7 cm wide; fruiting calyx lobes less than 8 cm long.
      d^1. Stipules long, semipersistent; calyx wings 6 to 7.5 cm long. 2. *H. philippinensis.*
      d^2. Stipules short; calyx wings 3.5 to 4.3 cm long.... 1. *H. basilanica.*
    c^2. Leaves more than 15 cm long; calyx wings 8 cm long or longer. 3. *H. mindanensis.*
  b^2. Leaves ovate or lanceolate.
    c^1. Leaves long-acuminate, without domatia..... 5. *H. acuminata.*
    c^2. Leaves not long-acuminate; domatia prominent..... 4. *H. plagata.*
a^2. Secondary nerves numerous, close, indistinct, almost parallel. § *Dryobalanoides.*
  b^1. Leaves elliptic, cuneate at base, 8 to 12 cm long; fruit wings 4 to 5.5 cm long ..... 6. *H. malibato.*
  b^2. Leaves and fruit smaller..... 7. *H. Foxworthyi.*

1. **HOPEA BASILANICA** Foxworthy. **Dalindingan, yacal.**

Hopea basilanica FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 260, *pl. 42;* § C 13 (1918) 183; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 93.

Large trees, up to 64 m tall and 62 cm in diameter, with thick, black, furrowed bark, like that of *H. acuminata.* Stipules short, early deciduous. Leaves chartaceous, narrowly oblong or elliptic to oblanceolate, glabrous and shiny above except for the slightly pubescent midrib, 10 to 15 cm long, 2.2 to 4.8 cm wide, apex acuminate, tapering and unsymmetrical at base; secondary nerves 10 to 12 pairs, ascending and bent upward at margin of leaf, domatia in axils of at least lowest pairs of nerves; tertiary nerves parallel, reticulate; petiole dark-colored and wrinkled when dry, 6 to 12 mm long. Inflorescences terminal and axillary, mostly from the axils of fallen leaves, occasionally two inflorescences from one axil, few-flowered racemose panicles, not much branched, usually shorter, or not much longer than, leaves; peduncles and branches pubescent. Flowers (described from *For. Bur. 27248,* collected in Basilan, June, 1918, said to be yellow, pedicels short, less than 1 mm long. Sepals broadly ovate, about 1 mm wide and 1.5 mm long, tomentose outside, glabrous within. Petals ovate, tomentose on exposed portion, glabrous within, opaque, about 3.5 mm long and 1.5 mm wide. Stamens 15, attached to petals at base; filaments slender, about 0.4 mm long; anthers ellipsoid, about 0.1 mm long; appendage to connective as long as, or considerably longer than, anther. Ovary pubescent, surmounted by short cylindrical stylopodium; stylopodium about 0.5 mm in diameter; ovary and stylopodium about 1.5 mm long, 0.8 mm in diameter at base; style about 0.1 mm long; stigmas minute. Fruit 3 to 4 mm in diameter, 4 to 5 mm long; resin cavities in lower part of fruit; fruiting calyx with 2 long wings 3.5 to 4.3 cm long and 10 to 15 mm wide, with about 9 principal nerves; wings yellow when dry, nerves of darker color, nut and base of wings very dark brown; bases of the 2 large wings expanded so as to nearly conceal the 3 small ones.

BASILAN, *For. Bur. 15220 Klemme* (type in Philippine National Herbarium) August, 1910.

The wood is said to be of the quality of yacal.

The tree is said to be found in flat land, ridges, and slopes, from sea level up to about 70 m. It is known with certainty

only from Basilan. One collection (*For. Bur. 27940*) of very imperfect material is credited to Sibutu.

2. HOPEA PHILIPPINENSIS Dyer. Gisok-gisok.

Hopea philippinensis DYER, Journ. Bot. 16 (1878) 100; VIDAL, Rev. Pl. Vasc. Filip. (1886) 62; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 64; EVERETT & WHITFORD, Philip. Bur. For. Bull. 5 (1906) 16, 28, 53; WHITFORD, Philip. Bur. For. Bull. 10[2] (1911) 75, *pl. 79;* FOXWORTHY, Philip. Journ. Sci. § C 4 (1909) 515; § C 6 (1911) 261; § C 13 (1918) 183; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 94; REYES, Philip. Journ. Sci. 22 (1923) 338, *pl. 30, fig. 2;* SYMINGTON, Gard. Bull. S. S. 8 (1934) 32; 8 (1935) 279.

A medium-sized tree with thin, dark-colored bark. Stipules linear-lanceolate, acute, 2 to 3.5 cm long, semipersistent. Leaves thinly coriaceous, narrowly oblong, caudate-acuminate, base very unequal-sided, obtuse, almost glabrous, midrib and the 17 to 22 pairs of secondary nerves prominent beneath, domatia conspicuous; leaf blade 10 to 15 cm long, 3 to 5 cm wide; petiole very short, 6.5 mm long, black, wrinkled. Inflorescences usually from axils of fallen leaves, not much branched, usually shorter than leaves. Flowers sessile or very short-stalked, a scar at the base seems to indicate that there have been bracts; flowers lightly colored and sweetly fragrant. Sepals pubescent or glabrous, ovate, apiculate, about 2.5 mm long, 2 mm wide. Petals oblong to lanceolate, exposed portion tomentose, 7 to 8 mm long and about 2 mm wide, with 7 or 8 principal longitudinal nerves. Stamens 15, in groups of 3 at base of petals; filaments about 0.2 mm wide at base and tapering into a filiform portion; anthers ellipsoid, about 0.3 mm long; appendage to connective slender, as long as or longer than, anther cells, sometimes 2 or 3 times as long, pubescent. Ovary almost hemispherical, about 1 mm in diameter and in height, narrowed into almost columnar stylopodium; stylopodium about 1.5 mm long and 0.3 mm in diameter, narrowed into the small, glabrous, 0.3 mm long style; stigma minute. Fruit with 2 long, spathulate calyx lobes, 6.5 to 7.5 cm long, 2 cm wide, very much narrowed toward base, red when fresh, sometimes becoming chocolate-colored on drying.

LUZON, Albay Province, *Cuming 879* (isotype in the Philippine National Herbarium). The flowers have been described from *Bur. Sci. 31296 Ramos & Edaño* (in the Philippine National Herbarium), collected in Panay, Capiz Province, Jamindan, April 15, 1918.

The wood is said to be of the *mangachapuy* grade and has been described by Reyes.[18]

The species is widely distributed in the nonseasonal part of the Archipelago. It is said to occur on slopes and to be abundant above 300 m elevation.

The recorded distribution is:

LUZON, Laguna, Tayabas, Camarines, and Albay Provinces. CATANDUANES. SAMAR. LEYTE. BILIRAN. NEGROS. PANAY. MINDANAO, Surigao, Agusan, Lanao, and Zamboanga Provinces.

3. **HOPEA MINDANENSIS** Foxworthy. **Bagasusu, ganon, magasusu (Zamb.).**

Hopea mindanensis FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 261, *pl. 43;* § C 13 (1918) 183; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 93; REYES, Philip. Journ. Sci. 22 (1923) 334, *pl. 29, fig. 2;* SYMINGTON, Gard. Bull. S. S. 8 (1934) 32.

A tree up to 34 m tall and 45 cm in diameter. Stipules linear-lanceolate, acute, semipersistent. Leaves narrowly oblong, very short-acuminate at apex, irregularly cordate and auriculate at base, midrib and 18 to 24 pairs of lateral nerves prominent beneath, 15 to 35 cm long, 6 to 11 cm wide; petiole very short, 5 to 15 mm long, pubescent. Inflorescences borne in clusters from axils of fallen leaves, branched, shorter than leaves. Flowers (described from *Bur. Sci. No. 37069*, collected in Zamboanga Province, Mindanao, November, 1919) light-colored, slightly fragrant, short-stalked, about 8 mm long and 4 mm wide before petals spread; pedicel less than 1 mm long. Sepals glabrous, broadly ovate to almost orbicular, convex, finely apiculate or blunt at apex, 3 mm long and 2.5 mm wide. Petals tomentose on portion exposed in bud, otherwise glabrous, 5 to 6 mm long, about 2 mm wide, with numerous faint longitudinal nerves. Stamens 15; filaments broad, about 0.3 mm wide above base, abruptly narrowed to filiform; anthers ellipsoid, about 0.3 mm long and 0.2 mm wide; appendage to connective slender, as long as or longer than anther. Ovary and stylopodium up to 2 mm long and 1 mm in diameter at base, glabrous, gradually narrowing into scarcely distinct style; stigma minute. Fruit large, distinct from accrescent calyx lobes; 2 large fruiting calyx lobes ovate, tumid at base, limb broadly spathulate, rounded at apex, gradually attenuate to base, principal longitudinal nerves 7.

[18] Tom. cit., p. 338.

MINDANAO, Zamboanga Province, Banga, *For. Bur. 9029 Whitford & Hutchinson,* December 2, 1907, in yacal forest, altitude about 30 m (type in the Philippine National Herbarium).

This species is very distinct from *H. philippinensis* by reason of the much larger leaves and fruit.

The wood is said to be of the yakal grade and has been described in detail by Reyes.[19]

The species has been found only in Zamboanga Province, Mindanao.

4. HOPEA PLAGATA (Blanco) Vidal. Gyam.

Hopea plagata (Blanco) VIDAL, Rev. Pl. Vasc. Filip. (1886) 62; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 64; MERRILL, Govt. Lab. Publ. 27 (1905) 22; Sp. Blancoanae (1918) 269; Enum. Philip. Fl. Pl. 3 (1923) 94; FOXWORTHY, Philip. Journ. Sci. § C 2 (1907) 396; § C 4 (1909) 515; § C 6 (1911) 262; § C 13 (1918) 183; MERRITT, Philip. Bur. For. Bull. 8 (1908) 48; WHITFORD, Philip. Journ. Sci. § C 4 (1910) 715; Philip. Bur. For. Bull. 10[2] (1911) 73, *pls. 76, 77;* REYES, Philip. Journ. Sci. 22 (1923) 335, *pl. 31, fig. 2.*

Mocanera plagata BLANCO, Fl. Filip. (1837) 447.

Dipterocarpus plagatus BLANCO, Fl. Filip. ed. 2 (1845) 311; ed. 3[2] (1878) 212.

Anisoptera plagata BLUME, Mus. Bot. Ludg.-Bat. 2 (1852) 42; A. DC., Prodr. 16[2] (1868) 616.

Shorea reticulata F-VILL., Noviss. App. (1880) 21, *non* Dyer.

Hopea odorata VIDAL, Sinopsis Atlas (1883) 15, *t. 15, fig. a,* excl. fruit, *non* Roxb.

Hopea odorata FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 183, *non* Roxb.

Hopea sp. "Gyam" FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 263; "*paina*" FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 285.

Large trees up to 55 m high and 180 cm in diameter, with thick, fissured, black bark. Leaves lanceolate to ovate, chartaceous or coriaceous, glabrous, 5 to 12 cm long, 1.5 to 5 cm wide, apex acuminate, base cuneate; secondary nerves 8 to 12 pairs, with domatia in axils of some on underside; petiole 3 to 25 mm long; young leaves distinctly viscid. Inflorescences axillary, often from axils of fallen leaves, usually shorter than leaves and not much branched, 2 to 4 cm long. Flowers (described from *Loher no. 12914,* collected at Oriud, Rizal Province, Luzon) with short pedicels, which are usually less than 1 mm long. Sepals broadly ovate or orbicular, 2 mm high and wide, sometimes finely apiculate at apex, tomentose outside, glabrous within. Petals ovate-lanceolate, tomentose outside, glabrous within, spreading

[19] Tom. cit., p. 334.

in anthesis, about 3 mm long and 2 mm wide. Stamens 15 (Blanco says 30), borne in threes at base of petals; filaments broadened above base and then narrowed to filiform, 2.5 to 3 mm long; anthers almost orbicular, about 0.6 mm long and wide; appendage to connective tapering, as long as or longer than anther. Ovary without distinct stylopodium, conical, tapering gradually into stout style; stigma blunt or obscurely 3-parted; total length of pistil about 3 mm, maximum diameter about 1 mm. Fruit (described from *Loher no. 14901*, collected in Rizal Province, Luzon, July, 1913) with 2 long fruiting calyx lobes which are oblong or elliptic, 4 to 5 cm long, about 2 cm wide, narrowed at base to fit base of fruit, with 15 or more principal longitudinal nerves; the 3 short wings 0.5 to 2 cm long, broadly ovate or elliptic; nut about 1 cm long and about 7 mm in diameter, conical, tomentose, tapering to obscurely 3-parted stigma.

There is no type material extant for the plant described by Blanco; however, the species is an important one, as the wood, under the name of yakal, is widely used and is much esteemed because of its great strength and durability. Reyes [20] has given a detailed description of the wood. Blanco stated that there were 30 stamens, but Vidal's figure [21] indicates that there are 3 at the base of each petal. Vidal gives no number for the collection from which the drawing was made, but lists it as from San Miguel de Mayumo, Bulacan Province. He first credited this form to *H. plagata*,[22] and cites his *no. 84* from Bongabon, Nueva Ecija Province. Brandis [23] stated that this number was sterile. I had seen no flowering material when I wrote my earlier papers, and the fruit was not well known. Loher's excellent collections have made it possible to give a more complete description.

In my first paper of this series [24] I mentioned two forms, known only from sterile material, which it now seems belong here. One of these [25] was known as *gyam* and had been collected only once (*For. Bur. 13380*) on Tawitawi Island. It was considered distinct because of the small size of the leaves, but, collections now available seem to indicate that it is within the range of variation of the species. Another form (*Bur. Sci.*

[20] Tom. cit., p. 335.
[21] Sinopsis Atlas (1883) under *H. odorata* var.
[22] Rev. Pl. Vasc. Filip. (1886) 62.
[23] Loc. cit.
[24] Philip. Journ. Sci. § C 6 (1911) 231.
[25] Tom. cit., p. 263.

13141, collected in Tayabas Province) was considered distinct because of what was believed to be a curiously shaped immature fruit; I was unable to place it in a genus and listed it[26] among species of uncertain position. It is now evident that what was supposed to be an immature fruit was really an insect gall, and that the form belongs to *H. plagata*. There have since been other collections from Tayabas Province that show the same form of insect gall (*For. Bur. 20823* and *Bur. Sci. 25529*).

Of the nearly 60 collection sent me all are sterile except the following:

LUZON, Rizal Province, in flower, March, *Loher 12914;* in fruit, July, *Loher 14892, 14901:* Bataan Province, in fruit, July, *For. Bur. 25889, 26133:* Camarines Province, fallen fruit, November, *For. Bur. 22645, 22649:* Nueva Vizcaya Province, fruit, July, *For. Bur. 29530, 29531, 29532.*

It would seem that flowers are borne during the dry and fruit during the rainy season. It is said that the tree does not bear flowers every year, but only at irregular intervals.

The recorded distribution is as follows:

LUZON, Cagayan, Ilocos Norte, Nueva Vizcaya, Pangasinan, Nueva Ecija, Tarlac, Zambales, Bataan, Rizal, Bulacan, Tayabas, Camarines, and Sorsogon Provinces. MINDORO. TABLAS. BOHOL. MINDANAO, Cotabato and Zamboanga Provinces. BASILAN. TAWITAWI.

5. HOPEA ACUMINATA Merrill. Dalindingan, mangachapuy.

Hopea acuminata MERRILL, Govt. Lab. Publ. 29 (1905) 30; Philip. Journ. Sci. 1 Suppl. (1906) 98; Enum. Philip. Fl. Pl. 3 (1923) 93; WHITFORD, Philip. Journ. Sci. § C 4 (1910) 703; Philip. Bur. For. Bull. 10[2] (1911) 75, *pl. 80;* FOXWORTHY, Philip. Journ. Sci. § C 2 (1907) 389; § C 4 (1909) 514, *pl. 27, fig. 68;* § C 6 (1911) 264; § C 13 (1918) 183; REYES, Philip. Journ. Sci. 22 (1923) 339, *pl. 30, fig. 1;* SYMINGTON, Gard. Bull. S. S. 8 (1934) 22.

Hopea maquilingensis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 184.

Tall, slender trees up to 40 m high and 1 m in diameter. Branchlets nearly black when dry, glabrous, striate. Leaves broadly lanceolate, submembranous, glabrous, shiny above, narrowly acuminate at apex, rounded and inequilateral at base, 4 to 8 cm long, 2 to 3 cm wide; secondary nerves 8 to 10 pairs, rather prominent beneath; petioles 5 to 8 mm long, rugose, glabrous. Inflorescences grayish stellate-pubescent, axillary and terminal panicles, 5 to 6 cm long or less, spicate branches unilateral, 1.5 cm long or less. Flowers small, light-colored, fragrant.

[26] Tom. cit., p. 285.

Sepals imbricate, rusty pubescent outside, outer two slightly larger than inner. Petals slightly pubescent on the outside, falcate, 4 mm long, 1.8 mm wide, obtuse. Stamens 10; filaments thick; anthers 0.4 mm long; appendage to connective slender, usually longer than anther cells. Ovary glabrous or pubescent, 0.8 to 0.9 mm tall, 0.7 to 0.8 mm in diameter; style short, glabrous; stylopodium none; stigma minute. Fruit glabrous, 2 long wings oblong, about 2 cm long, 5 mm wide, apex rounded.

LUZON, Bataan Province, Mount Mariveles, *Merrill 3864* (type of fruit of *H. acuminata* Merr. in the Philippine National Herbarium), August, 1904; *For. Bur. 786 Borden* (type of flower of *H. acuminata* Merr. in the Philippine National Herbarium), May, 1904: Laguna Province, Mount Maquiling, *F. Canicosa, s. n.* (type of *H. maquilingensis* Foxw. in the Philippine National Herbarium), August, 1904. Six other specimens from the type locality were cited with the original description.

H. acuminata is distinct in form of leaf and in flower characters.

H. maquilingensis Foxw. was described from fruiting material of what seemed to be a distinct form of tree. The tree was of small size, with thinner, lighter-colored, and less deeply fissured bark. Merrell [27] considers it a synonym of *H. acuminata;* the features mentioned may be within the natural range of variation of the species.

A detailed description of the wood has been given by Reyes.[28]

This tree is common in hill forests, in both the seasonal and the nonseasonal parts of the Archipelago, at from 100 to 800 m altitude, but more abundant above 300 m.

Distribution.—BABUYANES. LUZON, Cagayan, Ilocos Norte, Nueva Vizcaya, La Union, Pangasinan, Tarlac, Nueva Ecija, Bataan, Bulacan, Laguna, Tayabas, Camarines, Albay, and Sorsogon Provinces. MINDORO. TICAO. MASBATE. SIBUYAN. SAMAR. LEYTE. NEGROS. PANAY. MINDANAO, Misamis, Cotabato, Davao, and Zamboanga Provinces.

6. **HOPEA MALIBATO** Foxworthy. Yacal, malibato, dalindingan.

Hopea malibato FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 1953; Philip. Journ. Sci. § C 13 (1913) 184; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 93.

Small or medium-sized trees. Leaves firmly chartaceous, glabrous, elliptical or ovate-elliptical, long-caudate-acuminate at apex, cuneate or acute at base, 8 to 12 cm long, 3 to 4.5 cm wide;

[27] Tom. cit., p. 93. [28] Tom. cit., p. 339.

petiole 10 to 12 mm long. Infrutescences axillary, short. Flowers unknown. Fruiting calyx lobes, the 2 larger 4 to 5.5 cm long, 12 to 15 mm wide, chartaceous, reddish, glabrous, 8- to 9-nerved; the 3 shorter ones scarcely exceeding fruit. Nut very short-pedunculate, 8 to 9 mm long, less in diameter, with sticky resin.

MINDANAO, Agusan Province, Cabadbaran, Mount Urdaneta, *Elmer 13526* (type in the Philippine National Herbarium), August, 1912.

A collection of sterile material, *For. Bur. 13789*, from Zamboanga Province, Mindanao, may belong here. It was from a large tree.

7. HOPEA FOXWORTHYI Elmer. Dalindingan isaak (Laguna, Tayabas); pisac (Cagayan); mangachapuy (Laguna, Sibuyan); sugcao (Samar).

Hopea foxworthyi ELMER, Leafl. Philip. Bot. 6 (1912) 1469.
H. Pierrei FOXWORTHY, *non* Hance, *pro parte* Philip. Journ. Sci. § C 6 (1911) 265; § C 13 (1918) 184; WHITFORD, Philip. Bur. For. Bull. 10[2] (1911) 76; BROWN and MATTHEWS, Philip. Journ. Sci. § A 9 (1914) 439, 481; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 94; REYES, Philip. Journ. Sci. 22 (1923) 339, *pl. 31, fig. 1.*
H. glutinosa ELMER, Leafl. Philip. Bot. 6 (1912) 1470.

Medium-sized trees; branchlets glabrous, only petioles and ramifications of inflorescence slightly puberulous. Leaves glabrous, 4 to 6 cm long, 1.5 to 2 cm wide, folded in bud upon upper surface, paler green beneath, lanceolate or ovate-lanceolate, caudate-acuminate, rounded or subcuneate at base, gradually tapering into 1 to 1.5 cm long apical portion which terminates in an obtusely rounded or emarginate tip, small hairy glands (domatia) often found in axils of secondary nerves; petiole 5 to 8 mm long, at first puberulent, ultimately glabrous. Inflorescences axillary, usually shorter than leaves. Flowers said to be pale green (unopened), on glabrous pedicels about 1 mm long. The only available flowering specimens are too immature for detailed study. Fruit on pedicels 2 to 3 cm long. The two long fruiting calyx lobes oblanceolate, 2.5 to 3 cm long, about 7.5 mm wide; the 3 shorter lobes about 5 mm long, obtuse. Nut ovoid-conical, 1.5 cm long, 6 mm in diameter, often coated with a smooth resin coat.

BASILAN, *Elmer 12071* (type in the Philippine National Herbarium), March, 1910, on a ridge at about 600 m elevation; *Elmer 12071* (cotype of *H. glutinosa* Elmer in the Philippine National Herbarium), collected on the same island. I formerly considered most of the material placed here to belong to *H. Pier-*

rei Hance, a species which I now believe not to occur in the Philippines, although some of the Philippine material has leaves very like those described for that species. None of the Philippine flowering material, discussed below, shows a stylopodium, which is quite pronounced in *H. Pierrei.*

I am in agreement with Merrill in considering *H. glutinosa* and *H. Foxworthyi* the same species, the latter name having page priority.

The species seems to occur on ridges or high land at from 100 to 600 m above sea level in the nonseasonal part of the Archipelago.

The tree is of small or medium size, rather thin-barked; the wood is of the mangachapuy grade.

The following collections are placed here, though all, except where specified, are sterile:

LUZON, Cagayan Province, *For. Bur. 17206, 17256:* Laguna Province, *Phil. Pl. (Merrill) 397,* in fruit, August, 1910; *Bur. Sci. 9882, For. Bur. 10150, 10157,* seedling; *1532, 17645,* fruit, February, 1910; *20710, 20714, 22499, 22500, 24665,* with immature flowers, November, 1916: Tayabas Province, *Whitford 792,* with immature flowers, September, 1904; *For. Bur. 23018, 30971,* fruit, June, 1929. SAMAR, *For. Bur. 20999.* SIBUYAN, *Elmer 12289* (type of *H. glutinosa*), in fruit, April, 1910; *For. Bur. 22603.* PANAY, Capiz, *For. Bur. 23932.*

Several collections remain of very uncertain status, and are here considered:

Bur. Sci. 28486 was collected in flower in Tayabas Province May, 1917, and was credited by Merrill to *H. malibato,* from which it differs by the thicker coriaceous leaves which are rounded at the base. It seems to me distinct; but its position will remain in doubt until flowering material of *H. malibato* and fruiting material of this form are available for study. The description of the flowering material from Tayabas is as follows: Inflorescences axillary and terminal, glabrous or sparsely pubescent, 3 to 15 cm long. Flowers said to be yellow; pedicels about 1.5 mm long, pubescent. Sepals ovate, about 2 mm long, 1.5 mm wide, blunt at apex, concave, pubescent outside, glabrous within. Petals oblong-lanceolate, slightly twisted in bud, blunt at apex, 5 to 6 mm long, 1 to 1.5 mm wide at base, rather opaque, portion exposed in bud silky, rest glabrous. Stamens 15; filaments slender, up to 0.9 mm long; anthers ellipsoid, about 0.1 to 0.2 mm long; appendage to connective much longer than anther.

Ovary ovoid-columnar, glabrous, without stylopodium, 0.6 mm in diameter, 0.8 mm long, tapering into the glabrous 1.5 mm long style; stigma minute.

The following collections have flowers very like the above, but have much smaller leaves: *For. Bur. 6726,* collected in Mindoro in April, 1907, flowers immature; *For. Bur. 21833, 21991, 23828, and 23834,* all collected in Zamboanga Province, Mindanao, May, 1914, said to be pinkish and with structures like that of *Bur. Sci. 28486.* Their leaves, however, are much smaller and of different shape. *For. Bur. 26249,* collected on Polillo in October, 1910, has flowers much like the above, but with rather larger petals and considerable pubescence on petioles, peduncles, and pedicels. It is, perhaps, most closely related to *H. foxworthyi. For. Bur. 24753,* collected in Tayabas in November, 1915, seeming to have a shorter ovary, but with too immature flowers for complete description, would seem to be closely related to *H. foxworthyi. Phil. Pl. (Merrill) 1623,* collected in Samar, April, 1914, has flowers much like *H. Forworthji* and is, perhaps, the same. *For. Bur. 21146,* collected in Camarines, April, 1914, has rather larger flowers than the other forms examined, the stamens being distinctly larger. It is probably a distinct form.

Besides these, there are a number of collections of sterile material, most of it apparently closely related to *H. foxworthyi,* but showing considerable variation in form and size of leaves.

All of these doubtful forms need further collecting before they can be definitely determined.

4. Genus BALANOCARPUS Beddome

This genus has been regarded as distinct by reason of its calyx lobes, which are pointed and do not exceed the fruit. Symington [29] has called attention to the lack of natural generic characters, which will probably lead to the disruption of the genus in the near future. As at present constituted, this genus contains about 15 species, the position of some of which is very doubtful. Species are credited to Ceylon, India (Madras Presidency), the Malay Peninsula, Borneo, and the following from the Philippines.

Key to the Philippine species of Balanocarpus.

a^1. Calyx wings only about one-half as long as fruit; leaves narrowly oblong ..... 1. *B. cagayanensis.*

a^2. Calyx wings nearly as long as fruit; leaves lanceolate. 2. *B. brachypterus.*

[29] Gard. Bull. S. S. 8 (1934) 27.

1. **BALANOCARPUS CAGAYANENSIS Foxworthy. Plate 3. Narek.**

Balanocarpus cagayanensis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 194, *pl. 2;* MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 101; REYES, Philip. Journ. Sci. 22 (1923) 335, *pl. 29, fig. 1;* SYMINGTON, Gard. Bull. S. S. 8 (1934) 27, 32.

Large tree. Leaves oblong, acuminate, faintly cuneate, slightly rounded, or slightly inequilateral at base, 7 to 13 cm long, 2 to 4 cm wide, margin slightly inrolled; secondary nerves 10 to 12 pairs, with occasional intermediate short ones; tertiary nerves approximate, mostly parallel; domatia in axils of secondary nerves, glabrous above, almost glabrous beneath, with occasional scattered hairs. Flower clusters not distinctly unilateral, black or dark gray. Petals yellowish brown in dried material, about twice as long as sepals, pale sericeous on outside, glabrous within. Stamens with filaments expanded at base, attached to base of petals and, more or less, to each other, forming at least an indication of a monadelphous condition; anthers almost round, equal; connective prolonged into a tapering awn, distinctly longer than anther. Gynœcium hour-glass-shaped. Ovary subspherical, stylopodium as long as ovary, almost columnar, abruptly narrowed into style, which is rather less than half as long as ovary; stigma shallowly notched. Fruit 1 to 1.3 cm long, about 1 cm in diameter, roughly conical, apiculate. Calyx wings of about equal length, less than two-thirds the height of fruit.

LUZON, Cagayan Province, Claveria, *For. Bur. 19987 Bernardo* (type in the Philippine National Herbarium), August, 1913.

This species has been found only in northern Luzon, all but one of the collections being from Cagayan Province. One collection is from Apayao Subprovince. The wood is said to be very good for house posts, in sandy places to be as good as molave (*Vitex* spp.), and may last 50 years or more. One collector reports that this species does not bear flowers yearly, but once every 4 or 6 years.

Symington [30] has called attention to the close relationship of the flowers of this species to those of *Hopea philippinensis* Dyer and of *H. mindanensis* Foxw., as well as to certain extra-Philippine species of *Hopea* and *Balanocarpus*.

2. **BALANOCARPUS BRACHYPTERUS Foxworthy. Babase (Sub.).**

Balanocarpus brachypterus FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 195; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 101; SYMINGTON, Gard. Bull. S. S. 8 (1934) 27, 28.

[30] Tom. cit., pp. 27, 32.

A medium-sized tree. Leaves chartaceous, elliptic or oblong to ovate-lanceolate, apex blunt-acuminate, base rounded or subcuneate, margin crenulate, glabrous except along principal nerves, where there is a sparse pubescence, mainly of grayish pilose hairs, with hairy domatia in the axils of nerves on underside, 5.8 to 7.3 cm long, 2.7 to 3.8 cm wide; secondary nerves 10 to 12 pairs; tertiary nerves rather indistinct, mainly reticulate; petioles 3 to 5 mm long. Inflorescences axillary, 4 to 5 mm long, lax, few-flowered; peduncle and branches slender, glabrous or pubescent. Flowers "small, violet, not odorous, and not showy," about 3 mm long, on stout, pubescent pedicels 1 to 1.5 mm long. Sepals broadly ovate, acute at apex, about 1.5 to 2 mm long and wide, tomentose outside, smooth within. Petals oblong, about 3 mm long and 1 mm wide, tomentose outside, glabrous within. Stamens 15, small; filaments filiform, slightly expanded at base, several times longer than anther; anther oblong, about 0.1 mm long; appendage to connective aristate, considerably longer than anther. Ovary and stylopodium tomentose, about 1.3 mm long and 0.6 mm in diameter, abruptly tapering into 0.3 mm long style; stigma minute. Fruit ovoid, about 1 cm long and 9 mm in diameter. Calyx lobes triangular-ovate, imbricate, rather closely surrounding and a little shorter than fruit. Margins of calyx lobes frequently brownish and scarious, sometimes very slightly reflexed. Fruit conical, faintly pubescent, with thin pericarp, the short style projecting through a small circular depression at apex. Style glabrous, about 0.5 mm long.

MINDANAO, Zamboanga Province, Naganaga, *For. Bur. 21895 Villamil* (type in the Philippine National Herbarium), May 18, 1914. The flowers were described from *For. Bur. 31304 Zamuco*, collected in Zamboanga Province, April, 1930.

This species has been found only in one district. The wood seems to be of the quality of dalindingan.

Symington [31] has called attention to the close relationship of this species to *B. Curtisii* King, and, possibly, to another species of the Malay Peninsula.

5. Genus PENTACME A. de Candolle

The generic characteristics, as given by Brandis, are:

Sepals strongly imbricate. Petals broad, spreading. Stamens 15. Anthers oblong, on short broad filaments. Anther-cells equal, each prolonged

[31] Tom. cit., pp. 27, 28.

into a short appendix; the connective also prolonged, so that each anther has 5 apical appendages. Ovary glabrous or pubescent, prolonged into a conical stylopodium; style filiform, glabrous. Stigma obtuse, indistinctly 3-partite. The 3 outer segments of fruiting-calyx much larger than the others, narrowed into a stalk, but expanding into a broad base, which is adpressed to the lower portion of the fruit, but does not enclose it.

Wood of the Philippine forms soft, light-colored, light in weight, coarse-grained, not durable.

Four species are known, 2 from the eastern Indian Peninsula and 2 from the Philippines.

It seems surprising that the genus should be represented in the Philippines and that its wood should be so different from that produced by the genus elsewhere. *Pentacme siamensis* (Miq.) Kurz is the representative species of the genus from the Indian Peninsula (It may be considered doubtful if *P. tomentosa* Craib is really distinct). It occurs at from 25° north latitude in Burma southward through Burma, Siam, and Indo-China, to a little north of 6° north latitude in the Malay Peninsula. It occurs where there is a distinct and prolonged dry season and where there are frequent fires. The wood of this species is very dense, very heavy, and very durable, a tremendous contrast with the wood of the Philippine forms.

Key to the Philippine species of Pentacme.

a^1. Leaves ovate or oblong, less than 15 cm long..... 1. *P. contorta.*
a^2. Leaves lanceolate, more than 15 cm long..... 2. *P. mindanensis.*

1. **PENTACME CONTORTA (Vidal) Merrill and Rolfe. Anas, apnit, balac, balagbag, bayucan, bugugnan, bunga, danlig, guiscan, lauan, malaanonan, malacayan, malasinoro, malatiaong, mayapis, sandana.**

Pentacme contorta (Vidal) MERRILL & ROLFE, Philip. Journ. Sci. § C 3 (1908) 115; MERRITT, Philip. Bur. For. Bull. 8 (1908) 48; WHITFORD, Philip. Journ. Sci. § C 4 (1910) 703; Philip. Bur. For. Bull. 10^2 (1911) 61, *pls. 56, 57;* FOXWORTHY, Philip. Journ. Sci. § C 4 (1909) 511, 516; § C 6 (1911) 266; § C 13 (1918) 186; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 95; REYES, Philip. Journ. Sci. 22 (1923) 332, *pl. 25.*

Shorea contorta VIDAL, Sinopsis Atlas (1883) 15, *fig. e,* Rev. Pl. Vasc. Filip. (1886) 88; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 88; MERRILL, Philip. Journ. Sci. 1 Suppl. (1906) 98.

Pentacme paucinervis BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 73.

Large trees, reaching a height of 40 to 50 m and a diameter of 150 cm. Stipules minute, early caducous. Leaves glabrous, ovate, acuminate at apex, rounded or subcordate at base, margin undulate or entire; secondary nerves 6 pairs; tertiary nerves parallel, not conspicuous, joined by reticulate veins; blade 10 to

14.5 cm, petiole 2.5 cm long. Inflorescences terminal and axillary panicles, the ramifications of which, as well as outside of sepals and petals, are gray with dense stellate tomentum. Flowers white, somewhat fragrant, nearly 1.25 cm long, on short obconical pedicels. Sepals ovate, 4 mm long, 2 to 3 mm wide, puberulous within. Petals elliptic, lanceolate, or ovate, narrowed at top and base, spreading after surpassing sepals, 9 to 10 mm long, 5 mm wide, with about 15 longitudinal nerves. Stamens 9 to 10 mm long, filaments stout, 2.5 to 3 mm long, 0.6 mm wide at base, narrowed about 1.7 mm above base to stalk about 1 mm long; anthers linear, 4.5 to 5 mm long, 0.6 mm wide at base, narrowing above to pointed apex which, like appendage to connective, is only about 0.5 mm long. Ovary depressed, spherical, faintly lobed, glabrous or pubescent, 1.2 mm high, about 2 mm in diameter, narrowing into long, cylindric, faintly ridged style, which is 5.5 mm long, 0.4 mm in diameter at base and 0.2 mm at top; stigma slightly concave, pubescent. Fruit tomentose, acuminate; wings of fruiting calyx twisted, very unequal, the two largest 7 to 13 cm long, with 10 to 12 prominent nerves, the third 6.5 cm long, the others much smaller. The number of nerves is variable as is also the size of fruit. All parts of wings densely stellate pubescent when young.

TYPES: *Shorea contorta* Vidal was described from *Vidal 987* collected in Rizal Province; and *Vidal 2159*, collected in Tayabas Province. *Pentacme paucinervis* Brandis was described from *Vidal 79*, collected in Nueva Ecija and Tarlac Provinces, *Vidal 1166*, collected in Ilocos Norte Province, and *Vidal 2167*, collected in Rizal Province.

This is one of the species producing the wood known as white lauan and very extensively used. The structure of the wood has been treated in detail by Reyes.

The tree is abundant in lowland forest from sea level up to about 700 m.

Distribution.—Known only from the Philippine Islands, where it is, apparently, the commonest and most widely distributed species of the family. It is found from the Babuyanes Islands to Basilan, and Whitford (1911), Foxworthy (1911), and Merrill (1923) have suggested that it is probably found in every province. It is represented in the Philippine herbarium by collections from:

BABUYANES. LUZON, Cagayan, Isabela, Ilocos Norte, Ilocos Sur, Abra, Mountain, Nueva Vizcaya, Nueva Ecija, Tarlac,

Pangasinan, Bulacan, Zambales, Bataan, Rizal, Laguna, Tayabas, Camarines, Albay, and Sorsogon Provinces. POLILLO. MARINDUQUE. MASBATE. MINDORO. CEBU. SAMAR. LEYTE. NEGROS, Negros Occidental Provinces. SIBUYAN. MINDANAO, Agusan, Davao, Cotabato, Lanao, and Zamboanga Provinces. SAMAL. POLAUI. BASILAN.

Common names.—The 138 collections examined give many common names, among which *malaanonan* is the commonest in Rizal and Bulacan Provinces. The name *lauan* is also used in Rizal Province. It seems that *malaanonan* is a common name for species of *lauan* the wood of which is light-colored and coarse-grained. There are 17 collections from Rizal, several without common name, and 7 with the name *malaanonan*. The two collections from Bulacan have the name *malaanonan*.

2. PENTACME MINDANENSIS Foxworthy.

Pentacme mindanensis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 185; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 95; REYES, Philip. Journ. Sci. 22 (1923) 332, *pl. 24*.

Large trees. Leaves oblong-lanceolate, glabrous, bluntly acuminate at apex, rounded at base, 19 to 29 cm long, 8 to 10 cm wide; secondary nerves 8 to 12 pairs; petioles 2.5 to 4 cm long. Inflorescences terminal, paniculate; branches of inflorescence stellate-pubescent. Flowers white, spreading in anthesis, about 1.5 cm in diameter; pedicels slightly obconical, grayish pubescent, 1 to 2 mm long. Sepals imbricate, broadly elliptic, concave, 6 mm long, 5 to 6 mm wide, grayish pubescent outside, with a fringe of coarser pubescence along edge, puberulous inside, with very faint longitudinal veinlike markings. Petals grayish pubescent outside, yellow or brownish within when dry, spreading after surpassing sepals, obovate-elliptic, sometimes slightly retuse at top, narrowed to base, 12 to 13 mm long, 4.5 to 6 mm wide, with about 15 longitudinal nerves. Stamens 15, 8 mm long; filament thick, 3.5 mm long and 0.6 mm wide; anther cells narrowly oblong, mucronate at apex, 4.5 mm long, each anther narrowed to apex; appendages short, 0.5 to 1 mm long. Ovary depressed-hemispheric, densely pubescent, 1.8 mm high, 2 mm in diameter, tapering abruptly into long, cylindric, pubescent, faintly ridged style, which is 6.6 mm long and 0.3 mm in diameter, slightly concave at apex to hold the rather flat stigma. Fruit pubescent, 3 cm long, 13 to 14 mm in diameter; long wings 7 to 8 cm long, 15 to 17 mm wide; short wings 2.5

to 3 cm long, 6 to 7 mm wide; longitudinal nerves 12 to 14, transverse veins numerous, distinct, oblique.

MINDANAO, Zamboanga Province, *For. Bur. 21893 Villamil* (type in the Philippine National Herbarium), May 25, 1914.

The species is very like *P. contorta*, differing principally in the larger size of nearly all parts.

It is known only from Mindanao and Basilan.

6. Genus SHOREA Roxburgh

The generic characters, as given by Brandis, are:

Large resinous trees; stipules in a few species large and persistent, in most small and early deciduous. Leaves coriaceous; secondary nerves prominent; tertiary nerves mostly parallel. Flowers as a rule in unilateral spikes or racemes, these distichous, and regularly alternating on the branches of large axillary and terminal panicles. Each flower subtended by two mostly deciduous, in a few species persistent and conspicuous bracts. Sepals strongly imbricate, always hairy outside, and often inside also, on the margin of a broad obconical receptacle. Petals oblong, rarely ovate-oblong, hairy on the outside. Stamens generally 15, in some species more. Anther-cells generally equal; connective prolonged into a pointed appendage, generally longer than anther, sometimes short or wanting. Segments of fruiting-calyx with their broad bases tightly enclosing the fruit, the three outer ones generally longer than the others and much longer than the fruit. In one section the segments of fruiting-calyx shorter or not much longer than the fruit.

This genus is the largest of the order and comprises about 120 species, distributed throughout the principal range of the family. About two-thirds of the species are from the Malayan region.

Several of the most important Philippine timbers are produced by species of this genus.

Divisions of the genus.—Brandis has called attention to the variability of different floral organs within the genus and has indicated the difficulty of making clearly marked divisions. This difficulty still exists, and it is further necessary to make another section of the genus, because of the reduction of *Isoptera* from generic rank.

Key to the Philippine species of Shorea.

a^1. Appendage to connective ciliate.
  b^1. Fruit with 3 long wings. § 1. *Eushorea.*
    c^1. Leaves green on both sides..... 1. *S. guiso.*
    c^2. Leaves lighter-colored on underside.
      d^1. Leaves cuneate or subcuneate at base.
        e^1. Secondary nerves 8 to 9 pairs..... 6. *S. ciliata.*
        e^2. Secondary nerves about 14 pairs..... 5. *S. malibato.*

d^2. Leaves rounded at base.
e^1. Style scarcely distinct..... 4. *S. astylosa.*
e^2. Style distinct.
f^1. Leaves ovate-oblong, 16 cm long, 7 cm wide..... 2. *S. gisok.*
f^2. Leaves oblong to oblong-lanceolate, 8.5 to 12 cm long, 3 to 6 cm wide ..... 3. *S. falciferoides.*
b^2. Fruit wings not exceeding fruit (§ 2. *Isoptera*)..... 7. *S. seminis.*
a^2. Appendage to connective not ciliate.
b^1. Stamens 15 to 17 or 23 to 30; no stylopodium. Flowers large. Wood yellow. Anthers oblong; appendage long, filiform, naked. Style longer than ovary. § 3. *Anthoshorea.*
c^1. Stipules distinct, semipersistent; leaves stellate-pubescent. 8. *S. philippinensis.*
c^2. Stipules small and fugacious; leaves glabrous.
d^1. Leaves usually distinctly lighter-colored beneath, retuse at apex. 9. *S. polita.*
d^2. Leaves of same color on both surfaces, acute at apex. 10. *S. kalunti.*
b^2. Stamens 15, anthers short (except in *S. negrosensis*); appendage sometimes scabrous at end, not ciliate; with or without distinct stylopodium. § 4. *Pinanga.*
c^1. Leaves glabrous throughout.
d^1. Fruit wings stellate-pubescent..... 11. *S. plagata.*
d^2. Fruit wings glabrous..... 12. *S. polysperma.*
c^2. Leaves stellate-pubescent beneath.
d^1. Stipules broadly ovoid, acute or obtuse..... 13. *S. squamata.*
d^2. Stipules lanceolate-acuminate.
e^1. Anthers small, orbicular; stamens about 15..... 14. *S. almon.*
e^2. Stamens more numerous; anthers large, oblong. 15. *S. negrosensis.*

Section 1. EUSHOREA

Fruiting calyx with 3 long wings; stamens 20 to 60; appendage of connective ciliate. Stylopodium usually large, hairy ovary; style short; stigma minute. Flowers in unilateral spikes or racemes, these distichous, alternating.

All Philippine species of this section produce wood which is hard and heavy, and, with the exception of *S. guiso*, of the yacal grade, of a yellowish or brownish color. Collections of fertile material have been few, with the consequence that descriptions are not complete. Some species, moreover, may have to be reduced after further collections, and it is possible that additional species are represented by some of the sterile material.

Nearly all of the forms included here have leaves that are lighter-colored on the underside when mature; the young leaves and leaves of saplings are usually of the same color on both surfaces.

Various species are abundant locally. *S. guiso* is the most common and widely distributed. It is also the only species of the group represented by sufficiently complete material to make possible detailed descriptions of both flowers and fruits. *S. gisok* is found in southeastern Luzon and the Visayas and is most commonly known by the name *gisok*. *S. astylosa* is found most commonly in Zamboanga Province, Mindanao, where it is known as *yacal*. *S. ciliata* is recorded from Tayabas with the name *yacal*, and from Biliran. *S. falciferoides* is known principally from Zambales and Pangasinan Provinces, with the name *yamban*. *S. malibato* was described from Agusan Province, Mindanao, where it has the names *malibato* and *dungon-dungon*. Sterile material, which seems, to belong to this species, has been collected as far north as Tayabas and the Camarines Provinces. The species has also been recorded from British North Borneo.

1. **SHOREA GUISO (Blanco) Blume.**

Shorea guiso (Blanco) BLUME, Mus. Bot. Ludg.-Bat. (1852) 34; VIDAL, Sinopsis Atlas (1883) 15, *t. 15, fig. c;* BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 89; PERKINS, Frag. Fl. Philip. (1904) 23; MERRILL, Philip. Journ. Sci. 1 Suppl. (1906) 98; Sp. Blancoanae (1918) 270; Enum. Philip. Fl. Pl. 3 (1923) 97; FOXWORTHY, Philip. Journ. Sci. § C 2 (1907) 384; § C 4 (1909) 509, *pl. 27, fig. 70;* § C 6 (1911) 272; § C 13 (1918) 191; Mal. For. Rec. 10 (1932) 175; EVERETT & WHITFORD, Philip. Bur. For. Bull. 5 (1906) 16; MERRITT & WHITFORD, Philip. Bur. For. Bull. 6 (1906) 36; MERRITT, Philip. Bur. For. Bull. 8 (1908) 48; WHITFORD, Philip. Journ. Sci. § C 4 (1910) 703; Philip. Bur. For. Bull. 10[2] (1911) 71, *pls. 74, 75;* REYES, Philip. Journ. Sci. 22 (1923) 337, *pl. 28;* VAN SLOOTEN *ex* Merr. in Univ. Calif. Publ. Bot. 15 (1929) 203; DESCH, Mal. For. Rec. 12 (1936) 20, *pl. 3, fig. 3;* SYMINGTON, Gard. Bull. S. S. 8 (1935) 266, *pl. 16.*

Mocanera guiso BLANCO, Fl. Filip. (1837) 449.

Dipterocarpus guiso BLANCO, Fl. Filip., ed. 2 (1845) 313.

Euphoria malaanonan BLANCO, Fl. Filip. (1837) 286.

Anisoptera guiso A. DC., Prodr. 16[2] (1868) 616.

Shorea robusta F.-VILL., Noviss. App. 21 (1880) *non* Gaertn.

Shorea vulgaris LANESSAN, Pl. Utiles Col. Fr. (1886) 301; PIERRE, Fl. For. Cochinch. 15 (1890) *t. 232.*

Shorea Vidaliana BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 83.

Shorea longipetala FOXWORTHY, Mal. For. Rec. 10 (1932) 174, *pl. 13.*

Large trees, 40 to 55 m tall and up to 180 cm in diameter. Branchlets dark-colored, pubescent. Leaves lanceolate or ovate-lanceolate to oblong, acute or acuminate at apex, rounded or subcuneate at base, glabrous or nearly so, 5 to 19 cm long and 1.8 to 8 cm wide; secondary nerves 12 to 16 (or even 26) pairs;

petioles usually 1 to 3 cm long, dark pubescent. Panicles axillary, terminal, 4 to 8 cm long, with numerous short, few-flowered branches. Flowers short-stalked or almost sessile; buds elongate with slightly twisted corolla. Sepals deltoid, ovate, blunt, tomentose outside, 1 mm high, 1.3 mm broad. Petals 9 to 10 times as long as sepals, linear-oblong, obtuse, slightly expanded at base, with slightly irregular margins, pale sericeous outside, smooth and darker-colored inside, longitudinal nerves about 15, about 1 cm long and 1.5 mm wide at base. Stamens 20 to 41 (*vide* Symington), apparently in groups of 3, filaments dilated at base; anther cells shortly oblong, about 0.2 mm long; connective produced into an apical process which is slightly reflexed and has 1 to 8 cilia, cilia usually longer than anther cells. Ovary hemispherical, narrowing above into stylopodium, both long, tomentose, about 1 mm in diameter and, with stylopodium, about 1.3 mm high; style short; stigma minute. Fruit with 3 long wings expanded at base to enclose nut, then oblanceolate, obtuse at apex, grayish pubescent or tomentose, densely so at base, 3 to 4 cm long, 8 to 10 mm wide, with 7 to 10 longitudinal nerves; 2 short wings expanded at base to enclose nut, then linear-oblong, 2 to 2.5 cm long, 2 to 4 mm wide, with about 5 longitudinal nerves, pubescence as in the long wings; nut almost spherical, gray tomentose, about 1 cm in diameter, prolonged into a beak about 5 mm long. The fruit is rather variable. The description was made from *For. Bur. 22076*. Usually the wings are rather short and distinctly grayish pubescent, thus contrasting with those of *S. polysperma*, which are much longer, more slender, and not so pubescent. Nut of *S. polysperma* also distinctly smaller.

There is no type specimen extant; but illustrative material distributed by Merrill, in Species Blancoanae, is *no. 407*, from Limay, Bataan Province, Luzon.

Whitford's description of the tree states:

> It has a straight, regular bole, strongly buttressed, that is from three-fifths to two-thirds the height of the tree. The crown is irregularly globular in shape, somewhat open, especially in the dry season. Guijo is found in all the dipterocarp types. While it is tolerant of shade it does better in slightly open places.
>
> The bark of guijo is 5 to 6 mm. in thickness. Long exposed bark is light brown in color with corky pustules and sheds in scroll-shaped or nearly rectangular patches. Freshly exposed bark is cinnamon brown in color. The inner bark is light reddish brown in color and stringy in texture.

The wood has been described in detail and figured by Reyes [32] and Desch.[33]

The form which I have called "pubescent guijo" [34] may be, as Whitford suggested (*fide For. Bur. 11798*), only a young form of this species. Numbers representing this form are *For. Bur. 5899, 6373, 6506, 6933, 10076, 10393, 11798, 12679, 17520, 17699, 17782,* and *Bur. Sci. 10845.*

For. Bur. 22712, collected in Tayabas Province, Luzon, was determined by me as *S. scrobiculata* Burck.[35]

Merrill [36] credits this collection to *S. guiso,* and Symington [37] agrees with him. The leaves of the specimen are very similar to those of that species; but the fruit, with its slender long wings and differently shaped nut, seems to place it elsewhere. The wood is reputed to be a yacal. This form will remain in doubt until flowering material from it can be examined.

S. guiso is one of the most widely distributed Philippine species, being recorded from Indo-China, Siam, the Malay Peninsula, and Borneo. In the Philippines it is very widely distributed, from northern Luzon to southern Mindanao and Basilan. It is usually of rather scattered occurrence in lowland forest and seems to be about the fifth most abundant timber tree of the Archipelago.

2. **SHOREA GISOK** Foxworthy sp. nov. Plate 4.

Shorea balangeran Auct. *non* Dyer; DYER *ex* Vidal, Phan. Cuming Philip. (1885) 97; VIDAL, Rev. Pl. Vasc. Filip. (1886) 61; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 86; FOXWORTHY, Philip. Journ. Sci. § C 4 (1909) 508, 516, *pl. 27, fig. 67;* § C 6 (1911) 269; § C 13 (1918) 187; WHITFORD, Philip. Bur. For. Bull. 10 [2] (1911) 73, *pl. 78;* MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 96; REYES, Philip. Journ. Sci. 22 (1923) 336, *pl. 27.*

Ramuli, petioli, racemique lepidoto-velutini, fulvi. Folia e basi rotundata, ovato-lanceolata vel elliptica, acuminata, supra glabra, subtus tenuissime lepidoto-velutina, flavicantia, 10 ad 14 cm longa, 4 ad 6.5 cm lata, nervis secondariis 10 ad 12, tertiariis parum distinctis, parallelis et reticulatis; petioli 2 ad 2.5 cm longi. Racemi folio æquales vel breviores. Sepala deltoi-

[32] Philip. Journ. Sci. 22 (1923) 337, pl. 28.
[33] Mal. For. Rec. 12 (1936) 21–26, pl. 3, fig. 3.
[34] Philip. Journ. Sci. § C 6 (1911) 274.
[35] Philip. Journ. Sci. § C 13 (1918) 192.
[36] Enum. Philip. Fl. Pl. 3 (1923) 97.
[37] Gard. Bull. S. S. 8 (1935) 267.

dea, acuta, intus et extus tomentosa, 2.5 mm longa, 2 mm lata. Petala lineari-oblonga, intus glaber, extus pubescentia, 18 mm longa, 1.5 ad 3 mm lata. Stamina circiter 30, 1 mm longa, filamenta linearia, seta connectivi loculis bis longiore. Ovario conico, tomentoso, 2.5 mm alto, 1.5 mm diametro; stylo glabro, 0.3 mm longo; stigma minuta. Fructus ignotus.

Large trees, with brownish or yellowish pubescent twigs, petioles, and flower clusters. Crown with a light to brownish appearance because of color of underside of leaves. Leaves ovate-lanceolate or elliptic, acuminate at apex, rounded at base, glabrous and dark green above, much lighter-colored beneath because of a fine lepidote covering, 10 to 14 cm long, 4 to 6.5 cm wide; secondary nerves 10 to 12 pairs; tertiary nerves not very distinct because of pubescence, but with a parallel and reticulate arrangement; petioles 2 to 2.5 cm long. Inflorescences terminal and axillary, about as long as leaves or shorter; peduncles pubescent or tomentose. Flowers almost sessile, pedicel only about 0.1 mm long. Sepals deltoid, acute, 2.5 mm long, about 2 mm wide. Petals spreading, linear-oblong, blunt at top, about 18 mm long, 1.5 to 3 mm wide, pubescent outside. Stamens numerous, in groups, about 1 mm long; filament slender, linear, 0.6 mm long; anthers ovate, acute, about 0.4 mm long; appendage to connective slender, pointed, about as long as anther cells, with a number (6 or 7) of long hyaline cilia, which may not be seen with a low magnification. Ovary conical, tomentose, about 2.5 mm high and 1.5 mm in diameter, tapering into short, glabrous, 0.3 mm long style; stylopodium not distinct, or only a slight swelling at upper part of the ovary; stigma minute. Fruit unknown.

LUZON, Tayabas Province, *For. Bur. 25657 Cailipan* (type in the Philippine National Herbarium), June 2, 1916.

This form was first credited to the Islands by Dyer, on *Cuming 884*, from Albay Province. He referred it to *Shorea balangeran* (Korth.) Dyer, a species of Borneo and some other Islands of the Netherlands Indies; his identification was accepted as correct by subsequent workers, although, in 1918, I mentioned that this form differs from Korthals's species in the number of stamens, which are ciliate, and in the shorter style. Some years later, Dr. D. F. van Slooten, at Buitenzorg, told me that he was sure that the reference of the Philippine material to Korthals's species was wrong. Symington [38] says:

[38] Gard. Bull. S. S. 8 (1935) 272, 273.

S. collina, which clearly belongs to the section *Eushorea*, is remarkable in the number of stamens, the shape of the filaments, and the large, short-winged nut. The flower structure is very similar to that of a species erroneously considered by Philippine botanists to be *S. balangeran* (Korth.) Dyer ex Vidal. These species (*S. collina* and *S. balangeran* Auct. non Dyer) are, however, readily distinguishable on vegetative and fruiting characters . . . From the Philippines I have seen three sheets (*For. Bur. 27099, 27381, and 31057*) that are remarkably similar to *S. Foxworthyi* in vegetative characters. Floral dissection, however, shows that the species is quite distinct, although clearly a member of the same group.

and in a footnote: "27099 and 27381 are cited in Merr. Enum. Phil. Pl. 3 (1923) 96 as *Shorea Balangeran* (Korth.) Dyer ex Vidal, but it is very evident that they are not that species." Unfortunately the three numbers cited were not included in the material sent me for study.

It seems evident that this form is distinct from *S. balangeran;* I have described it as new, using for the specific name the vernacular name of the tree in the place where early collections were made.

At the time of my first paper of this series (1911) there had been but one collection of flowering material, *For. Bur. 7096 Kobbe.* That collection was not sent me for this study, but it seems to be the material from which Whitford's plate 78 was prepared. It seems to represent very faithfully the form of the leaves and flower clusters.

Merrill [39] says of *S. balangeran,* "Although this is represented by more than 60 individual collections, all are sterile except the following": He lists eight numbers, only three of which were available for this study, and only one, *For. Bur. 25657,* seems to belong here.

The tree is a large one and produces wood of the grade of yacal. It is known only from the nonseasonal part of the Islands, where it is common in certain districts.

Its distribution, as determined by sterile material, seems to be:

LUZON, Tayabas, Camarines, and Albay Provinces. SAMAR. LEYTE. SIBUYAN. MINDANAO, Agusan, Surigao, and Davao Provinces.

3. SHOREA FALCIFEROIDES Foxworthy. Yamban, matibia (Zamb.); pamayawasen (Pang.)

Shorea falciferoides FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 189.

[39] Tom. cit., p. 96.

A large tree with oblong to oblong-lanceolate, coriaceous leaves which are glabrous, or nearly so, dark green above, distinctly lighter and finely pubescent beneath, 8.5 to 12 cm long, 3 to 6 cm wide, rather abruptly blunt-acuminate at apex, rounded at base; secondary nerves 12 to 14 pairs, occasionally with domatia in axils of some of lower nerves, tertiary nerves not conspicuous; petiole 15 to 20 mm long, grayish pubescent, as are also the twigs and branches of the inflorescence. Stipules small, fugacious. Fruit conical, gray pubescent, tapering into the hairy persistent style, 7 to 8 mm in diameter and 7 to 10 mm tall. The three long accrescent calyx lobes 4 to 5 cm long, 10 to 12 mm wide, grayish pubescent, oblanceolate, with 8 to 10 principal longitudinal nerves and numerous, irregular crossveins, the short wings 2.5 to 3 cm long, 2 to 3 mm wide, oblanceolate, with about the same number of longitudinal nerves as the larger wings. Flowers unknown.

LUZON, Zambales Province, Masinloc, *For. Bur. 25664 Mayor* (type in the Philippine National Herbarium), June 8, 1916.

Merrill does not mention this species in his Enumeration but includes the type number, *For. Bur. 27170*, and the common name under *S. balangeran* (= *S. gisok*).

The species seems to be most closely related to *S. gisok*, from which it differs in size and shape of leaves. It is known from fruiting, and *S. gisok* from flowering material. Further collecting will be necessary before the two species can be fully described.

The common name in Zambales Province is *yamban*, often with some qualifying term. What is apparently the same species is known in Pangasinan as *pamayawasen*.

For. Bur. 27170, from Zambales Province, with young fruit, is also referred here. The following collections of sterile material may belong here: *For. Bur. 6507, 6931, 11045, 13203, 13204, 13205, 19469*, all from Zambales Province; and *For. Bur. 8278, 8279, 9635, 9637, 13478, 13487, 14390, 21262*, all from Pangasinan Province. Besides these there are three collections of incomplete material from Camarines, *For. Bur. 10643, 21714*, and *21716*, doubtfully referred here.

4. SHOREA ASTYLOSA Foxworthy. Plate 5. Yacal.

Shorea astylosa FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 188; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 96.

A very large tree, 25 to 30 m tall, 1 m or more in diameter. Wood very hard, dark brownish yellow, resinous. Leaves ovate,

entire, margins slightly inrolled, acuminate at apex, rounded at base, glabrous on upper surface, only slightly pubescent beneath, coriaceous, shiny, 6.5 to 9 cm long, 3.5 to 4.5 cm wide; petioles dark, slender, 1 to 2 cm long; secondary nerves 8 to 12 pairs, tertiary nerves fine, parallel, reticulate, almost as distinct above as below. Inflorescence axillary, paniculate, less than 5 cm long; branches of inflorescence, calyx, and outside of corolla grayish pubescent. Flowers pale to rusty yellow, with a sweet odor. Sepals broadly ovate, concave, imbricate, pubescent outside, smooth within, 1.5 mm long and wide. Petals oblong-lanceolate, rusty yellow, more or less twisted in bud, concave, rounded at apex, 8 mm long, 2 mm wide, distinctly pubescent on the part exposed in bud, faintly puberulous within. Stamens 20 to 30, less than 1 mm long, appendix to connective ciliate, about 0.3 mm long. Ovary pyramidal or conical, grayish pubescent, 1.5 mm tall, about 1 mm in diameter at base, bluntly rounded at apex; style scarcely distinct. Fruit unknown.

MINDANAO, Zamboanga Province, along Dumanguilis River, *For. Bur. 13271 Foxworthy & Demesa* (type in the Philippine National Herbarium), May 8, 1912.

This species differs from *S. gisok* by the shorter and relatively broader leaves, with a smaller number of secondary nerves, smaller flowers; and almost complete absence of a style. It differs from *S. ciliata* in the broader leaves, which are rounded at the base; and in the petals, ovary, and style.

Several collections have been made in the district where the type was collected; the species seems to be fairly common there. It has also been collected in Tayabas and Camarines Provinces, Luzon. Sterile material, which may belong to this species, has been collected in Samar and in Negros.

5. SHOREA MALIBATO Foxworthy. Plate 6. Malibato; yacal (Tayabas, Zamboanga); guisok, guisok amarillo (Camarines); guisok madlao (Leyte).

Shorea malibato FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 1955; Philip. Journ. Sci. § C 13 (1918) 189; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 97; VAN SLOOTEN, Univ. Calif. Publ. Bot. 15 (1929) 203.

A large tree with exceedingly hard wood. Branchlets and twigs grayish pubescent. Leaves lanceolate or ovate-lanceolate, glabrous, dark green above, much lighter-colored beneath, acute or acuminate at apex, rounded or subcuneate at base, 6 to 14 cm long, 2.5 to 5.5 cm wide; secondary nerves about 14 pairs, tertiary nerves parallel, reticulate, not prominent; petiole 12 to 15 mm long, pubescent. Fruit small, almost spherical, with 3

broadly spathulate membranous wings and 2 narrowly spathulate shorter wings. Wings yellow when dry. Fruit covered with a sparse grayish pubescence and enclosed by the expanded bases of calyx lobes.

MINDANAO, Agusan Province, Cabadbaran, Mount Urdaneta, *Elmer 13525* (type in the Philippine National Herbarium), August, 1912.

Fruit and leaves were collected from different trees. Subsequent collections from different localities that have been referred here make it appear that the leaves described are from a rather young tree. Most of the collections have leaves that are whitish, or very light-colored, beneath. Other Philippine material referred here, *For. Bur. 22786,* from Zamboanga Province, Mindanao, and cited by me, was in fruit. The remaining collections, all sterile, are *For. Bur. 1, 4531, 11515,* Tayabas Province; *10647, 10730, 21221,* Camarines Province; *12732,* Leyte Province; *13296,* Zamboanga Province.

This species has been found only in the nonseasonal part of the Archipelago. It is very closely related to *S. ciliata* but differs in fruit and leaf characters. It is distinct from *S. falciferoides* by the more narrowly lanceolate leaves, of thinner texture, subcuneate at base, and drying darker. The fruits are larger and have glabrous, instead of pale-pubescent, wings as in that species.

Van Slooten [40] has recorded this species from British North Borneo, on Elmer's collections, *nos. 21653* and *21713,* from near Tawao, Elphinstone Province. Both of these collections are in flower; the following description is from *Elmer 21713:* Flower buds almost spherical. Sepals almost orbicular, tomentose, about 1.5 mm in diameter. Petals ovate or ovate-lanceolate, tomentose outside, glabrous within, about 4 mm long and 2 mm wide, with numerous longitudinal nerves. Stamens more than 30, filaments long and slender, some of them slightly broadened above base, up to 3 mm long; anthers about 1 mm long, pointed at top, covered with a number of short ciliæ; appendage to connective rather shorter than anther, covered with scattered ciliæ. Ovary almost hemispherical, tomentose, about 1.5 mm high, nearly 2 mm in diameter, abruptly narrowed into glabrous, stoutish, 0.5 mm long style; stigma rather smooth.

Additional collecting is needed to clear up the status of this form.

[40] Tom. cit., p. 203.

6. SHOREA CILIATA King.

Shorea ciliata KING, Journ. R. As. Soc. Beng. 62 [2] (1893) 118; BRUHL & KING, Ann. Bot. Gard. Calc. 5 [2] (1896) 154, *pl. 187a;* BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 82; RIDLEY, Flor. Mal. Penin. 1 (1922) 229; FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 188; Mal. For. Rec. 10 (1932) 171.

A medium-sized tree; young branches slender, dark, deciduously hoary puberulous. Leaves coriaceous, lanceolate or oblong-lanceolate, acuminate, base cuneate; both surfaces glabrous, minutely reticulate, lower usually whitish when dry; main nerves 5 to 9 pairs, ascending, curved, shiny on lower surface; length 7.5 to 9 cm, breadth 2 to 4 cm; petiole 19 to 23 mm long. Seedling leaves green on both surfaces. Panicles 5 to 6.5 cm long, axillary and terminal, little branched, few-flowered, hoary. Flowers yellow, very short-stalked, about 12 mm long, secund; buds elongate with twisted corolla. Sepals ovate-deltoid, obtuse, 2.5 to 3 mm long and wide, pale tomentose outside, glabrous inside. Petals narrowly oblong, obtuse, slightly expanded at base, margin slightly reflexed in upper part, 8 mm long, 2 mm wide at base, adpressed sericeous outside, glabrescent inside. Stamens 15 to 30, in fascicles of 3, unequal, the shorter with undilated filaments, the longer with filaments dilated in lower half; connective produced into an apical process crowned by 3 to 5 spreading cilia, which are longer than oblong anthers. Ovary with stylopodium ovoid-conic, sericeous, 2 mm tall, 1 mm in diameter, tapering into short glabrous style. Fruit ovoid, apiculate, pale tomentose, 12 mm long; accrescent sepals membranous, reticulate; 3 outer 5 cm long, 7 to 8 mm broad, 7-nerved, narrowly oblong, narrowed to above concave base; 2 inner 2.5 cm long, linear-lanceolate, few-nerved.

PENANG, *Curtis 1578* (type).

The two collections previously recorded are the only ones thus far known from the Philippines. Neither of these collections were sent me for this study, and I have had to include them without further study. The species description has been adapted from King.

Merrill [41] and Symington [42] think my identification a mistaken one and that the material I have placed here should be under *S. astylosa* Foxw.

[41] Enum. Philip. Fl. Pl. 3 (1923) 96.
[42] Journ. Mal. Br. R. As. Soc. 14 (1936) 348.

The two collections, in flower, are *Bur. Sci. 18575,* from Biliran Island, and *For. Bur. 22788,* from Tayabas Province, Luzon. They seem to me to belong to the Malayan species.

Section 2. ISOPTERA

Fruit supported by spreading coriaceous sepals, which are scarcely longer than fruit; 3 outer sepals orbicular, larger than inner. Sepals imbricate, unequal. Petals linear, much longer than sepals. Stamens 30 to 60: anther cells equal; appendix to connective ciliate. Ovary and stylopodium densely tomentose; style short, glabrous. Cotyledons plano-convex, enclosing hypocotyl, cells filled with fat.

This section was formerly regarded as a separate genus, but van Slooten called attention to the fact that the principal species really belongs to the genus *Shorea,* which makes it necessary to establish a new section of that genus. The floral structure shows that the section is closely related to *Eushorea.*

7. **SHOREA SEMINIS** (de Vriese) Van Slooten.

Shorea seminis (de Vriese) VAN SLOOTEN *ex* Merrill in Univ. Calif. Publ. Bot. 15 (1928) 204.

Hopea seminis DE VRIESE, Minjak Tengkawang (1861) 32.

Hopea ovalifolia FOXWORTHY *non* Boerl., Philip. Journ. Sci. § C 6 (1911) 263; § C 13 (1918) 183.

Isoptera borneensis SCHEFF. *ex* Burck in Ann. Jard. Bot. Buitenz. 6 (1887) 222, *t. 8;* BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 106; HEYNE, Nutt. Plant. Ned. Ind. 3 (1917) 310; FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 194, *pl 1;* Mal. For. Rec. 10 (1932) 238; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 101; REYES, Philip. Journ. Sci. 22 (1923) 336, *pl. 26.*

A large tree. Leaves oblong or oblong-lanceolate, subacute, slightly narrowed to rounded or subcordate base; upper surface glabrous except puberulous midrib; lower surface light-colored, glabrous; main nerves 14 or 15 pairs, oblique, prominent beneath; length 17 to 26 cm, breadth 6 to 8 cm; petiole 2 cm long, pubescent. Stipules caducous. Panicles axillary and terminal, about 15 cm long, stellate-pubescent. Bracts caducous. Flowers short-pedunculate. Calyx lobes minutely tomentose, rounded, 1 to 2 mm long. Petals minutely pale tomentose, 15 mm long, 2 mm wide. Stamens 30 to 60, in 3 series, filaments dilated at base: anthers equal, ovate; connective elongate, ciliate. Ovary sericeous tomentose as is stylopodium, style short, glabrous. Fruit supported by spreading coriaceous sepals; 3 outer

sepals orbicular, larger than inner. Cotyledons plane-convex, enclosing hypocotyl, cells filled with fat.

No. 902, 146434 in Herb. Lugd.-Bat. (type).

Sterile material that I formerly referred to *H. ovalifolia* Boerl. belongs here, as Merrill [43] indicated.

A large tree in lowland forest, usually in stream valleys. The wood is of the yacal grade and is used for heavy construction. The fat from the fruit seems not to be used in the Philippines. Of common occurrence in Borneo.

For. Bur. 9133, 9374, 22683, 23829, and *23839,* all from Zamboanga Province, Mindanao, have been referred here. It seems that the following sterile collections may also be referred here, *Bur. Sci. 15002,* from Albay Province [formerly cited by me under (*S. balangeran*)], *For. Bur. 20267,* from Zamboanga Province, *For. Bur. 21199* and *21738,* from Camarines, and *For. Bur. 25954,* from Samar.

Section 3. ANTHOSHOREA

Fruiting calyx with 3 long wings. Flowers large, stamens generally 15 to 17, in a few species 23 to 30; anthers oblong, connective terminating in a long, filiform, naked appendage, sometimes scabrous at end. Ovary mostly glabrous; style longer than ovary; stigma generally 3-dentate: no stylopodium.

The Philippine species of this section produce wood of the *mangasinoro* grade. This wood is pale yellow or whitish and used for temporary construction. The detailed wood structure of *S. mindanensis* Foxw. (*S. polita* Vid.) has been described by Reyes.[44]

8. **SHOREA PHILIPPINENSIS** Brandis. Saray (Cag.); danlig, malaanonang (Laguna); mangasinoro (Tayab.); malagangao (Cam.); banganon (Agusan); gagil-bato (Lanao).

Shorea philippinensis BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 88; FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 272; § C 13 (1918) 190; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 98; DESCH, Mal. For. Rec. 12 (1936) 27.

Shorea pallida FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 190.

Large trees, up to 30 m high and 120 cm in diameter. Twigs dark, stellate-pubescent, with short internodes. Stipular bracts enclosing bud triangular-ovate, rather large, semipersistent, with several longitudinal nerves; stipules leaving a distinct scar

[43] Tom. cit., p. 101.

[44] Philip. Journ. Sci. 22 (1923) 330.

on falling. Leaves 3.5 to 9 cm long, 3 to 5 cm wide, elliptic, coriaceous, pallid above and beneath when dry, very young leaves darker, bluntly acuminate at apex, rounded or subcordate at base, under side covered with stellate hairs; secondary nerves 10 to 15 pairs, tertiary nerves usually distinct, parallel; petioles 8 to 10 mm long, pubescent, with stellate hairs. Inflorescences longer than leaves, stellate-pubescent. Flower 1 cm long or longer, white or pale yellow. Stamens 15; appendage to connective filiform, longer than anther. Ovary with base of style puberulous; style filiform, glabrous, longer than ovary; stigma minute. Fruit green when fresh, reddish brown when dry, ovoid, about 1 cm long and about the same diameter, enclosed by bases of calyx lobes; 3 long wings oblong-spathulate, 7 cm long, 16 mm wide, with 10 to 12 longitudinal nerves and numerous reticulate crossveins; 2 short wings 4 to 6 cm long, 5 to 6 mm wide, with 5 to 6 longitudinal nerves.

LUZON, Bulacan Province, Angat, *Vidal 983* (fragment of type of *S. philippinensis* Brandis in the Philippine National Herbarium). Cagayan Province, Casambalangan, *For. Bur. 12996 Bernardo* (type of *S. pallida* Foxw. in the Philippine National Herbarium), July 17, 1911.

The type material was not available to me and so I have not described the flowers more completely. Collections were very few and the species was, for long, very imperfectly understood. *S. pallida* was described from fruiting material and was reduced, by Merrill, to this species.

The species differs from the two other Philippine species of this section in its conspicuous stipules and bracts and its stellate pubescent leaves.

It seems to occur in both the seasonal and nonseasonal parts of the Archipelago but is apparently not abundant.

Collections referred here are:

LUZON, Cagayan Province, *For. Bur. 7084, 17158* (type of *S. pallida*) : Laguna Province, *For Bur. 17652, 22290, 23471:* Tayabas Province, *For. Bur. 6068:* Camarines Province, *For. Bur. 27007.* LEYTE, *For. Bur. 12885.* MINDANAO, Agusan Province, *Elmer 14175:*[45] Davao Province, *For. Bur. 31281:* Lanao Province, *For. Bur. 25021.* BASILAN, *Bur. Sci. 15418, 16102, For. Bur. 18887.*

[45] Cited by me in Leafl. Philip. Bot. 6 (1913) 1956, as *S.* sp. aff. *S. Vidaliana* Brandis.

9. SHOREA POLITA Vidal. **Lauan, malaanonan.**

Shorea polita VIDAL, Sinopsis Atlas (1883) 15, *t. 15, fig. d;* Rev. Pl. Vasc. Filip. (1886) 61; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 88; FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 190; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 98; DESCH, Mal. For. Rec. 12 (1936) 39.

Mocanera malaanonan BLCO., Fl. Filip. (1837) 858.

Dipterocarpus malaanonan BLCO., Fl. Filip. ed. 2 (1845) 312.

Shorea malaanonan (Blco.) BL., Mus. Bot. Lugd.-Bat. 2 (1852) 34; A. DC., Prodr. 16 [2] (1868) 631; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 103; F.-VILL., Nov. App. (1880) 21; MERRILL & ROLFE, Philip. Journ. Sci. § C 3 (1908) 115; WHITFORD, Philip. For. Bur. Bull. 10 [2] (1911) 64; FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 270; § C 13 (1918) 189; MERRILL, Sp. Blancoanae (1918) 271.

Shorea mindanensis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 192; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 97; REYES, Philip. Journ. Sci. 22 (1923) 330, *pl. 21.*

Large tree. Leaves glabrous, distinctly lighter-colored on under side, ovate-lanceolate to elliptic or elliptic-lanceolate, acute at apex, rounded at base, 5 to 15 cm long, 2 to 7.5 cm wide; secondary nerves 12 to 15 pairs, tertiary inconspicuous, parallel, joined by dense reticulate venation; petiole 2 to 3 cm long. Flowers in unilateral spikes in large terminal panicles, the branches of which are slender. Sepals deltoid, pubescent, with straight hairs. Petals broadly oblong, blunt at apex, finely pubescent outside. Stamens about 15; filaments broadened at base, shorter than anther; anthers linear-oblong; appendage to connective elongate, about twice length of anther. Ovary conical, glabrous, narrowed into long cylindrical style; stigma 3-dentate. Fruiting calyx of a brilliant gray, the part which envelops the nut very round, with three long, usually unequal (5 to 8 cm) wings and 2 short (3 cm) and narrow, reddish-yellow, which are much reticulated and with about 10 nerves.

LUZON, Nueva Ecija Province, Bongabong, *Vidal 989* (type of *S. polita* Vidal). BASILAN, near Isabela, *For. Bur. 13769 Foxworthy, Demesa, & Villamil* (type of *S. mindanaensis* Foxw. in the Philippine National Herbarium), April 27, 1912.

The species has had various vicissitudes in terminology. Blanco, in 1837, gave a very indefinite description of what seems to be this species and gave it the name *Mocanera malaanonan.* He changed the name to *Dipterocarpus malaanonan* in his second edition (1845), but did not alter the description. Blume (1852) realized that it belonged to the genus *Shorea* and gave it the name *Shorea malaanonan.* His descriptive note did little but

mention the shape of the leaves and the light color of their under sides. DeCandolle (1868) took up Blume's name. He did not elaborate the description, but emphasized the whitish underside of the leaves and the three long wings of the fruiting calyx. The third edition of Flora Filipinas (1880) added nothing to the description, but gave it also in Latin. In the Novissima Appendix [46] however, is given "*Shorea Malaanonan* Bl.—*Mocanera malaanonan* Blanco—*Dipterocarpus malaanonan* Blanco—*S. stellata* Dyer. *Fructus* alae 2 maximae, 1 minor et 2 minimes. Stamina infra 20." This apparently adds nothing except to emphasize the *Shorea* type of fruit. It also shows the first confusion with *Parashorea* (*Shorea stellata* Dyer = *Parashorea stellata* Kurz). Vidal, in 1883, described *S. polita* from fruiting material, his *no. 989* being the type. Brandis (1895) added the description of the flowers,[47] but placed *S. malaanonan* with the insufficiently known forms. Merrill and Rolfe (1908) were the first to consider the two identical and reduced *S. polita* to synonomy. I followed them in this (1911), indicating that *S. polita* was merely a narrower-leaved form. Later (1918) I considered the two distinct, and both good species. Whitford [48] described *malaanonang-lauan* and stated that it was produced by *S. malaanonan.* He indicated that the common name, *malaanonang,* is used also for *Parashorea plicata* and *Pentacme contorta.* Merrill (1918) in his Species Blancoanae placed *S. malaanonan* in *Parashorea,* with the name *P. malaanonan,* keeping *S. polita* distinct, an arrangement which he retained in his Enumeration (1923). His argument was:

> I am now convinced that this interpretation (that of Merrill & Rolfe (l. c.) was erroneous; that *Shorea polita* is a valid species entirely distinct from *Mocanera malaanonan* Blanco, and that Blanco's species is identical with the common and widely distributed Philippine *Parashorea plicata* Brandis. Among all the Philippine Dipterocarpaceae *Parashorea plicata* Brandis is the only one that agrees with Blanco's description in the character of the leaves, whitish beneath, which are further described as wide, pointed, and a "geme" (i. e., 15 to 18 cm. long, while the pericarp of the fruit is described as fragile. The description conforms to *Parashorea plicata,* and I have not the slightest hesitation in adjusting the synonymy. The native name cited by Blanco, malaanonan, is valueless in interpreting the species, as it is a made-up one, literally "false anonang", *anonang= Cordia Myxa* Linn., and, as used to-day, is very loosely applied, although I have specimens of *Parashorea plicata* Brandis from Laguna Province, Luzon, bearing this name.

[46] Page 21. [47] Tom. cit., p. 103. [48] Loc. cit.

I have already stated [49] under *S. malaanonan,*

> Other species that have been considered as belonging here are *Parashorea plicata* and *Shorea polita.* The principal reason for considering the first is that it has the underside of the leaves whitish and is sometimes known by the common name of *malaanonan.* Both of these conditions are met by the other two species. Blanco's description refers to three long calyx-lobes in the fruit, which would certainly indicate *Shorea* rather than *Parashorea.* The description also mentions three stigmas, which is not the case in *Parashorea plicata.*

These facts seem to me to indicate that *Parashorea* was not meant. Merrill has called attention to the unsatisfactory nature of the common name, *malaanonan.* However, collections have shown the use of this name more commonly for *S. polita* and for *Pentacme contorta* than for *Parashorea.* The record, in the material sent me for study, is as follows: 101 Collections of *Parashorea plicata* show the use of this common name but once (from Laguna Province); the species not having been found in the locality where Blanco did his work; 138 collections of *Pentacme contorta* show the use of this name 13 times, 2 of them from Bulacan, no other common name being recorded on the collections from that province; 28 collections of *S. polita,* at no great distance from the part of Bulacan Province where Blanco worked for so many years, all of them from Rizal Province, show the use of this name 4 times. It seems, therefore, that such evidence as is furnished by the common name favors this species. I am now (as in 1911) inclined to believe that *S. malaanonan* and *S. polita* constitute one rather variable species, the latter name having originally been applied to the narrower-leaved forms. *S. polita* is adequately described and is represented by a type specimen. It is, therefore, the preferred name.

Mr. Symington, when he examined the Philippine material, indicated that he considered *Shorea mindanensis* Foxw. a synonym of *S. polita,* and I believe that he is right. The transfer was made by Desch.[50] The scanty collections of *S. mindanensis* do not show the whitish underside of the leaves, but otherwise they seem to fit this species.

S. polita is a species of the lowland forests, apparently of rather scattered occurrence, in both the seasonal and nonseasonal parts of the Islands. The wood is coarse-grained yellow lauan of the sort often known by the name *mangasinoro.*

[49] Philip. Journ. Sci. § C 13 (1918) 190.
[50] Tom. cit., p. 39.

The recorded distribution is as follows:

LUZON, Cagayan, Ilocos Sur, Pangasinan, Nueva Ecija, Zambales, Rizal, Laguna, and Tayabas Provinces. MINDORO. MINDANAO, Davao and Cotabato Provinces. BASILAN.

One collection, *For. Bur. 10333*, which I formerly identified [51] as *Pentacme* sp., has been placed by Symington in this species. I cannot agree with this, as the specimen seems to be distinct by reason of its distinct stipules, its pronounced tomentum, and its shape. The material is sterile, and a definite identification seems impossible.

10. SHOREA KALUNTI Merrill. Kalunti, mangasinoro.

Shorea kalunti MERR., Philip. Journ. Sci. 26 (1925) 475; DESCH, Mal. For. Rec. 12 (1936) 35, 39.

A tree about 50 m high, glabrous except the densely cinereous-pubescent inflorescences. Branches and branchlets terete, glabrous, with numerous small lenticels, usually dark brown when dry. Leaves 7 to 10 cm long, 3.5 to 5 cm wide, coriaceous, smooth, shiny, ovate to oblong-ovate or elliptic-ovate, pale olivaceous or sometimes greenish when dry, about the same color on both surfaces, narrowed upward to the obtusely acuminate apex, base subobtuse to rounded; lateral nerves about 7 on each side of midrib, slender, distinct, reticulations lax, not prominent; petioles 6 to 10 mm long, glabrous. Inflorescences axillary, densely and softly cinereous-pubescent with short hairs, flowers falcately arranged on ultimate branchlets. Flowers about 7 mm long, their pedicels stout, about 1 mm long. Sepals elliptic-ovate, obtuse, 2 mm long, densely pubescent. Petals oblong, 6 mm long, about 2 mm wide, obtuse, densely pubescent externally, twisted in anthesis. Stamens 15, minute anthers globose to ellipsoid, 0.2 mm long, apical appendage 0.3 mm long, slender, glabrous. Ovary glabrous below, minutely pubescent above; style pubescent, less than 1 mm long; stylopodium none. Young fruits oblong-ovoid, about 1 cm long, pubescent, accrescent sepals in fruit 5, oblanceolate to spathulate, rounded, about 8 mm wide, more or less pubescent, much narrowed below, the 3 longer ones up to 5 cm long, the 2 shorter ones nearly as long.

MINDANAO, Davao Province, Banauan, *For. Bur. 27701 Angeles & Hilario* (type in the Philippine National Herbarium), April 30, 1919. Fruit described from *For. Bur. 13294* and

[51] Philip. Journ. Sci. § C 6 (1911) 268.

13902 Foxworthy & Demesa, collected in Zamboanga Province, Mindanao, May and June, 1912. These two fruiting specimens and various sterile specimens doubtfully referred by me to *S. mindanensis* Foxw. have also been placed here.

This large tree of lowland forest is known only from southern Mindanao. It has been recorded from Davao, Lanao, and Zamboanga Provinces.

Section 4. PINANGA

Fruiting calyx with 3 long wings; stamens 15; anthers short; appendage of connective not ciliate, sometimes scabrous at the end.

Two of the species, *S. plagata* and *S. negrosensis,* may be incorrectly placed in this section. The former is known only from fruiting material, the latter has many more stamens, with rather long anthers. Their position is obscure, but they are placed here because stem structure seems to indicate closer relationship to this than to the other sections recognized as occurring in the Philippines.

11. SHOREA PLAGATA Foxworthy.

Shorea plagata FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 192.

Large trees, up to 40 m tall and 90 cm in diameter. Bark black, thick, furrowed or scaly. Stipules small, fugaceous. Leaves coriaceous, glabrous, ovate-lanceolate or elliptic, acuminate at apex, rounded at base; blade 6 to 12 cm long, 3 to 5.5 cm wide; secondary nerves 9 to 12; petioles 12 to 15 mm long, black. Flowers unknown. Fruit ovoid, sericeous, 12 to 15 mm long, 11 mm in diameter; 3 long wings spathulate, 7 cm long, 12 to 16 mm wide, with 7 to 10 longitudinal nerves and reticulate crossveins; 2 short wings 3 to 4 cm long, 2 to 3 mm wide, with about 6 longitudinal nerves. Wings with pubescence of scattered stellate hairs.

MINDANAO, Zamboanga Province, Fort Banga, *For. Bur. 13758 Foxworthy, Demesa & Villamil* (type in the Philippine National Herbarium), June 17, 1912.

The wood is a fine grade of red lauan, but harder and heavier than is usually the case with that wood. It has some resemblance to *guijo* and is sometimes locally known by that name.

The section of the genus to which this species belongs cannot be determined with certainty until flowering material is available.

Sterile material of this species was [52] referred to *Shorea* sp. Merrill [53] referred this species to *S. astylosa*, which it cannot possibly be.

The species is known only from Mindanao. It has been collected in Bukidnon, Lanao, and Zamboanga Provinces. Two collections from Lanao, *For. Bur. 30605* and *30631*, have immature flowers and may belong here. Flowering material from the type locality is needed.

12. SHOREA POLYSPERMA (Blanco) Merrill.

Shorea polysperma (Blanco) Merr., Philip. Govt. Lab. Publ. 20 (1905) 22; 29 (1905) 29; Philip. Journ. Sci. 1 Suppl. (1906) 98; Sp. Blanconae (1918) 269; Enum. Philip. Fl. Pl. 3 (1923) 99; Foxworthy, Philip. Journ. Sci. § C 2 (1907) 356, 357, 394; § C 4 (1909) 423, 510, 518, *pl. 27, fig. 72;* § C 6 (1911) 277; § C 13 (1918) 191; Everett & Whitford, Philip. Bur. For. Bull. 5 (1906) 26; Merritt, Philip. Bur. For. Bull. 8 (1908) 16, 48; Whitford, Philip. Journ. Sci. § C 4 (1910) 703; Philip. Bur. For. Bull. 10[2] (1911) 62, *pls. 66, 67;* Reyes, Philip. Journ. Sci. 22 (1923) 328, *pls. 19, 20.*

Mocanera polysperma Blanco, Fl. Filip. (1837) 448.

Dipterocarpus polysperma Blanco, Fl. Filip., ed. 2 (1846) 312.

Hopea tangili Blume, Mus. Bot. Lugd.-Bat. 2 (1852) 35.

Shorea talura F.-Vill., Novis. App. (1880) 21, *non* Roxb.

Shorea warburgii Gilg in Engl. Bot. Jahrb. 18 Beibl. 45 (1894) 38; Brandis, Journ. Linn. Soc. Bot. 31 (1895) 98; Foxworthy, Philip. Journ. Sci. § C 6 (1911) 278; § C 13 (1918) 191.

Shorea Teysmanniana Foxworthy, Philip. Journ. Sci. § C 6 (1911) 279; § C 13 (1918) 192, *non* Dyer; Whitford, Philip. Bur. For. Bull. 10[2] (1911) 68; Merrill, Enum. Philip. Fl. Pl. 3 (1923) 99; Reyes, Philip. Journ. Sci. 22 (1923) 326, *pl. 17.*

A very large tree of hill forests, at from 100 to 800 m above the sea, reaching a height of 50 m and a diameter of more than 2 m. Branchlets dark brown, glabrous. Leaves ovate-lanceolate, acuminate, 8 to 11 cm long, 3 to 5 cm wide, shiny, coriaceous, base rounded, rarely somewhat acute, apex usually rather long-acuminate; nerves 10 to 12 pairs, subprominent, ascending; petioles 2 cm long, glabrous or at first pubescent. Panicles 20 cm long or less, branches ascending, lower branches often 15 cm long, densely pubescent with gray hairs. Flowers small, yellowish. Sepals imbricate, broadly ovate, obtuse or subacute, 3 mm long, 2.5 mm wide, densely pubescent, three outer ones enclosing the two inner. Petals 8 mm long, 3.5 mm wide,

[52] Philip. Journ. Sci. § C 6 (1911) 279.
[53] Enum. Philip. Fl. Pl. 3 (1923) 96.

obtuse. Stamens 15, in two series, filaments broad, 1 mm long; anthers broadly ovate, 0.6 mm long, appendix to connective slender, as long as anther. Ovary pubescent, stylopodium very obscure or wanting; style slender, 1.5 mm long. In fruit all sepals accrescent, three outer sepals 4.5 cm long, 8 to 10 mm wide, obtuse; two inner sepals about 2 cm long or less, 3 mm wide.

For. Bur. nos. 606, 734, 784, 819, 1410, and Whitford no. 132, all from Bataan Province, Luzon, were cited with the original description: Cagayan Province, Peñablanca, *Warburgh 12399* (type of *S. Warburgii* Gilg) in the Kew Herbarium (type in the Philippine National Herbarium).

Merrill suggested that Blanco's use of the specific name *polysperma* was due to his having mutilated or very imperfect fruits. I think it more likely that Blanco's material had more than one ovule developed in each fruit. This abnormal development occasionally occurs in many members of this family.

Tiaong, a common hill form in Laguna and Tayabas, was referred by me to *S. Teysmanniana* Dyer, a species known only from sterile material collected in Bangka. Symington recently [54] described that species more fully, and his description does not fit the Philippine form known as tiaong, which is still known only from sterile material. The wood seems to be slightly lighter and softer than that of tanguile and the stipules seem to be larger, but these differences may not be constant; it seems best to consider the form known as tiaong as belonging to this species.

The wood is a good grade of red lauan, known on the market as tanguile. It is used for bancas, interior construction, and furniture.

S. polysperma is widely distributed in the Archipelago and has been recorded from the following regions:

BABUYANES. LUZON, Cagayan, Isabela, Ilocos Norte, Pangasinan, Nueva Ecija, Bulacan, Zambales, Bataan, Rizal, Laguna, Tayabas, Camarines, Albay, and Sorsogon Provinces. POLILLO. MARINDUQUE. MINDORO. NEGROS, Negros Occidental Province. CEBU. LEYTE. BILIRAN. PANAY, Capiz Province. SAMAR. SIBUYAN. MINDANAO, Agusan, Bukidnon, Lanao, Davao, and Zamboanga Provinces. BASILAN.

13. **SHOREA SQUAMATA** (Turcz.) Dyer. Mayapis, pura, kalian, alam, tabac.

Shorea squamata (Turcz.) DYER *ex* Vidal, Phan. Cuming Filip. (1885) 97; Rev. Pl. Vasc. Filip. (1886) 62; BRANDIS, Journ. Linn. Soc.

[54] Gard. Bull. S.S. 7 (1933) 134, pl. 38.

Bot. 31 (1895) 92; MERRILL, Philip. Journ. Sci. § C 2 (1907) 285; FOXWORTHY, Philip. Journ. Sci. § C 2 (1907) 386; § C 4 (1909) 519; § C 6 (1911) 275; § C 13 (1918) 191; Leafl. Philip. Bot. 6 (1913) 1957; MERRITT, Philip. Bur. For. Bull. 8 (1908) 16, 48; WHITFORD, Philip. Journ. Sci. § C 4 (1910) 715; Philip. Bur. For. Bull. 10[3] (1911) 66, *pl. 63.*

Hopea squamata TURCZ., Bull. Soc. Mosc. 31[1] (1858) 239; A. DC., Prodr. 16[2] (1868) 635.

Shorea floribunda F.-VILL., Novis. App. (1880) 21, *non* Kurz.

Shorea palosapis MERR., Sp. Blancoanae (1918) 271; Enum. Philip. Fl. Pl. 3 (1923) 98; REYES, Philip. Journ. Sci. 22 (1923) 325, *pl. 16.*

Shorea rugosa FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 191, *non* Heim.

A large tree up to 50 m high and 150 cm in diameter. Twigs dark, stellate-pubescent. Stipules broadly ovoid, acute or obtuse, large, semipersistent, leaving distinct scars on falling. Leaves coriaceous, ovate-oblong or elliptic, shortly acuminate at apex, rounded or cordate at base, upper side glabrous except for tomentose midrib, underside rough with tufts of stellate hairs; secondary nerves 14 to 18, curved, tertiary nerves parallel; blade 10 to 20 cm long, 6 to 10 cm wide; petiole 2 cm long, stellate-pubescent, with scattered hairs. Inflorescences axillary and terminal, longer than leaves, tomentose, with scattered tufts of stellate hairs; branches short, few-flowered, distichous, unilateral. Flowers almost sessile, bibracteolate, with oblong bracts, yellowish with slightly aromatic odor, about 9 mm long. Sepals deltoid, gray tomentose outside, 3 to 3.5 mm long, about 2 mm wide at base. Petals oblong or oblong-lanceolate, about 9 mm long and 3 mm wide, reflexed in anthesis, with numerous longitudinal nerves; tomentose outside, glabrous within. Stamens 15; "filaments of the 5 inner episepalous stamens with a thick rounded base, upon which the 5 outer episepalous filaments are inserted;" filaments about 0.3 mm wide at base, broad part 0.3 to 0.4 mm high, abruptly narrowed to the 0.2 mm long filiform portion below anther; anthers almost orbicular, about 0.3 mm in diameter, appendage to connective filiform, up to 1 mm long. Ovary and stylopodium almost conical, tomentose, about 1 mm in diameter at base and 1.5 mm tall, tapering into glabrous 1.5 mm long style; stigma minute. Fruit with nut ovoid, gray tomentose, about 2.5 cm long and 2 cm in diameter, 3 long wings 10 to 12 cm long (sometimes 15 to 17 cm), 1.5 to 2 cm wide, with about 10 longitudinal nerves; 2 short wings 4 to 6 cm (Brandis says 4 to 5 inches) long, 4 to 6 mm wide, with about 4 longitudinal nerves.

LUZON, Albay Province, *Cuming 883* [cotype of *Shorea squamata* (Turcz.) Dyer in the Philippine National Herbarium], *892*. The species was described from *Cuming's 883* and *892*.

The stipules are larger than in any other Philippine species of *Shorea;* they are persistent for a time, extending nearly around the stem. In some cases the stipules drop early, and although they leave distinct scars, it is more difficult to recognize the species. There is considerable variation in the amount of hairiness.

Whitford's description adds the following:

> The tree is strongly buttressed and has a regular bole with a length up to 25 or 30 m. The crown is spreading, flatly conical in shape, and dense.
>
> It is found more or less abundantly from the northern part of Luzon to the southern part of Mindanao. It does best on rich, deep, but fairly well-drained soils in the lowlands and seldom reaches an altitude of over 300 meters . . . It is confined to regions where the dry season is not pronounced.
>
> The bark is from 8 to 16 mm. in thickness: it is brown to dark brown or cinnamon brown in color, gray when exposed to strong light and black when wet. It is rather prominently ridged, especially above. The inner bark is stringy in texture and brown to slightly pink in color, especially a distinct vertical band beneath the furrows . . . This tree resembles closely almon-lauan, but can be distinguished from it by its darker colored bark and much coarser, larger leaves and more prominent hairs. The wood, also, is redder in color.

The plate in Whitford's paper gives a good representation of the leaves and stipules.

Merrill's change of the name to *S. palosapis* seems undesirable. If he is correct in his interpretation of Blanco's exceedingly scanty description ("Some botanists might consider his name a *nomen nudum* or at least a *nomen subnudum*")[55] it is evident that Blanco made a mistake and confused the common names *palosapis* and *mayapis*, both of which are usually applied to *Anisoptera thurifera* (Blco.) Bl. The name *palosapis* has not been found to be used for this species; the name *mayapis* is the most used name for it in certain sections, particularly in eastern Laguna Province and adjacent localities. It seems better, in view of the inadequate description, the mistake in the use of the common name, and the lack of type material, to discard the name *S. palosapis* and to retain the well-authenticated name *S. squamata*.

[55] Loc. cit.

Merrill [56] has reduced to synonomy the name *S. rugosa* which I used [57] for a collection, *For. Bur. 13293*, from Mindanao. The material has young fruit and is not typical of this species, differing in the shape of stipules and in the size and form of fruit; however, it may be within the range of possible variation of the species.

S. squamata has been credited to Borneo, on the one collection by Beccari in Sarawak.

The Philippine distribution, as shown by herbarium specimens, is:

LUZON, Cagayan, Isabela, Nueva Ecija, Bulacan, Rizal, Laguna, Tayabas, Camarines, Albay, and Sorsogon Provinces. POLILLO. MARINDUQUE. BOHOL. SAMAR. LEYTE. BILIRAN. MINDANAO, Agusan, Bukidnon, Misamis, Davao, Lanao, Surigao, and Zamboanga Provinces. BASILAN.

More than 100 collections indicate that *mayapis* is the commonest name.

14. SHOREA ALMON Foxworthy sp. nov. Plate 7. Almon.

Shorea furfuracea Auct. *non* Miquel; ROLFE, Journ. Bot. 23 (1885) 210; VIDAL, Rev. Pl. Vasc. Filip. (1886) 62; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 98; FOXWORTHY, Philip. Journ. Sci. § C 4 (1909) 517; WHITFORD, Philip. Journ. Sci. § C 4 (1910) 712; Philip. Bur. For. Bull. 10 [2] (1911) 63, *pls. 58, 59.*

Shorea eximia Auct. *non* Scheffer; FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 276; § C 13 (1918) 191; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 96; REYES, Philip. Journ. Sci. 22 (1923) 331, *pl. 23.*

S. squamata (Turcz.) Dyer similis, sed folia, stipulae, et ovario minores.

Large trees, gregarious. Bark ridged, 1.5 to 2 cm thick. Branchlets, stipules, petioles, underside of leaves, and branches of inflorescence with tufts of stellate hairs, which are sometimes very long. Leaves elliptic to ovate, shortly acuminate at apex, rounded at base, 9 to 12 cm long, 4 to 6 cm wide, underside with clusters of stellate hairs along nerves; secondary nerves 14 to 22 pairs, tertiary nerves parallel, prominent; petiole 1 to 2 cm long, stellate, tomentose. Inflorescences axillary and terminal, much branched, up to 25 cm long; peduncles scabrous, with tufts of stellate hairs. Flowers subtended by broadly ovate bracts, which are tomentose, 5 to 6 mm long and 3 to 4 mm

[56] Enum. Philip. Fl. Pl. 3 (1923) 98.
[57] Philip. Journ. Sci. § C 13 (1918) 191.

wide; pedicels 1 to 2 mm long, tomentose with stellate hairs; flowers spreading, about 7 mm high and 8 mm wide, said to be yellow and fragrant. Sepals broadly lanceolate, slightly recurved at apex, coarsely tomentose outside and smooth within, 3 mm long and 2 mm wide at base. Petals oblong, about 8 mm long and 3.5 to 4 mm wide, the portion exposed in bud tomentose, the rest glabrous, with about 10 longitudinal nerves. Stamens 15, in two series, the two series alike except for length of filaments; filaments of longer series 1 to 2 mm long, about 0.3 mm wide near base, tapering to a slender filiform portion below orbicular anthers, anthers about 0.3 mm in diameter, appendage to connective long-filiform, up to about 1.2 mm long. Ovary without stylopodium, finely tomentose, 1 to 1.5 mm high and about same diameter at base, tapering into filamentous, glabrous, 3 mm long style; stigma minute. Fruit almost spherical, tomentose, about 1 cm in diameter; fruiting calyx with 3 wings 9 to 12.5 cm long, 15 mm wide, narrowed below; base dilated, tightly enclosing fruit, 7 to 9 longitudinal nerves, transverse nerves prominent; the 2 short wings narrower, up to about 5 cm long. Young fruit and calyx wings pubescent or tomentose, with numerous scattered stellate hairs, some of which persist on mature fruit.

NEGROS, Occidental Negros Province, Cadiz, *For. Bur. 11647 Whitford* (type of *S. Almon* Foxw. in the Philippine National Herbarium), April 10, 1909.

This form was first credited by Rolfe (1885) to *S. furfuracea* Miq., on *Cuming 880*, from Albay Province, Luzon. This same reference was used by Vidal (1886). Brandis (1895) considered *S. eximia* (Miq.) Scheff. a synonym and referred to it two of Vidal's collections from Albay Province. He also gave a partial description of the flowers, presumably from the Philippine material: "Flowers only on the Philippine specimens, which have shorter elliptic leaves and are perhaps specifically different." Merrill [58] referred to *S. furfuracea* a sterile specimen of *S. guiso* from Bataan Province. In 1911 I reduced *S. furfuracea* Miq. to synonomy with *S. eximia* (Miq.) Scheff., which I believed to be the Philippine form. Ridley [59] stated that the Philippine material referred here was quite distinct from *S. furfuracea*. Merrill (1923) stated that our form apparently

[58] Philip. Journ. Sci. 1 Suppl. (1906) 98.
[59] Fl. Mal. Penin. 1 (1922) 233.

needed a new name. Van Slooten [60] called attention to the fact that *S. eximia* is distinct from *S. furfuracea*, and material identified by him as the latter species was quite distinct from the Philippine form here described as new.

S. almon is a large tree of wide distribution in lowland forest in the nonseasonal part of the islands. It is closely related to *S. squamata*, from which it differs in the smaller size of its leaves, its flower structure, and in its lighter-colored wood.

The recorded distribution of *Shorea almon* is:

LUZON, Tayabas, Camarines, Albay, and Sorsogon Provinces. NEGROS, Negros Occidental Province. SAMAR. LEYTE. MINDANAO, Surigao, Agusan, Bukidnon, Misamis, Lanao, and Zamboanga Provinces. BASILAN.

15. SHOREA NEGROSENSIS Foxworthy.

Shorea negrosensis FOXWORTHY, Philip. Journ. Sci. § C 6 (1911) 274, *pl. 44;* § C 13 (1918) 192; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 97; REYES, Philip. Journ. Sci. 22 (1923) 327, *pl. 18.*

Large trees, up to 50 m tall and 2 m in diameter. Bark thick, black, fissured. Twigs tomentose. Stipules small, triangular, nerved, hairy, fugacious. Leaves elliptic, oblong or ovate, smooth and dark green above, except for depressed, tomentose midrib, pilose or stellate hairy along nerves beneath, sharply acuminate at apex, rounded at base, 9 to 15 cm long, 4 to 6 cm wide; secondary nerves 12 to 16; tertiary nerves parallel, reticulate, distinct, with regularly placed tufts of stellate hairs; underside of leaf much like that of *S. almon*, but less hairy; petioles 1.5 to 2 cm long, tomentose; when dried, leaves often with a coppery color beneath. Inflorescences axillary and terminal, up to 15 cm long; branches short, unilateral, few-flowered; peduncle and branches tomentose, with stellate hairs. Flowers sessile, spreading in anthesis, about 1.5 cm across, "cream-colored, with sickish odor." Sepals with grayish tomentum of straight hairs outside, glabrous within, deltoid, about 2.5 mm long and wide, with numerous longitudinal nerves. Petals tomentose outside, glabrous within, broadly oblong or ovate, 6 to 7 mm long, 3 to 4 mm wide, ragged at top, with 10 to 12 very distinct longitudinal nerves. Stamens numerous, sometimes as many as 50, fascicled; filaments flattened at base, tapering to filiform below anthers, 3 to 4 mm long, 0.4 to 0.6 mm

[60] Univ. Calif. Publ. Bot. 15 (1929) 203.

wide at base; anthers oblong, rounded or acute at apex, about 1 mm long; connective a dark line between anther cells; appendage to connective fine, reflexed, tapering to a very fine point, distinctly shorter than anther. Ovary conical, tomentose, about 1.5 mm high, a little less in diameter, tapering into smooth, 1.5 mm long style; stigma slightly broader than style, obscurely lobed; no stylopodium. Fruit unkown.

NEGROS, Occidental Negros Province, along Himugaan River, *For. Bur. 7281 Everett* (type in the Philippine National Herbarium), May 22, 1907.

This form is of uncertain relationship. It does not fit the section *Pinanga*, as defined by Brandis, but it has been placed there as a matter of convenience, as its stem structure is very similar to that of some members of that section.

A tree of lowland forest, gregarious and occurring in great quantities in some localities.

The wood is a good grade of red lauan and has sometimes been marketed under the trade name of "Philippine mahogany."

Recorded distribution:

LUZON, Cagayan, Isabela, Nueva Ecija, Bulacan, Laguna, Tayabas, Camarines, Albay, and Sorsogon Provinces. POLILLO. BILIRAN. CEBU. SAMAR. LEYTE. NEGROS. MINDANAO, Surigao and Agusan Provinces.

7. Genus PARASHOREA Kurz

Large trees up to 50 or 60 m high and 2 m in diameter. Stipules leaving annular scars. Leaves light-colored beneath. Inflorescences axillary and terminal. Sepals imbricate in bud but soon opening at top and overlapping only at base, so as to appear valvate. Petals imbricate. Stamens 15; anthers linear, on short filaments, connective more or less prolonged; anther cells more or less unequal, two posterior cells shortly beaked. Ovary hairy. Fruit tomentose. Five long wings, narrowed below, not enclosing fruit. Cotyledons fleshy, equal or subequal, deeply bilobed.

Seedling development.—Certain species have seedlings which during their early development show only aciculate leaflike organs, which may be stipules. *P. plicata* usually has seedlings with leaves of normal type, but there is an indication of aciculate organs at some of the early nodes.

Wood.—The wood is coarse in texture and of the lauan type. Reyes [61] has given a detailed account of the wood structure.

[61] Philip. Journ. Sci. 22 (1923) 330.

Resin.—The resin is usually scanty in amount and apparently of no value.

Trees characteristic of the nonseasonal parts of the islands, where they are abundant. Reproduction copious. Flowering and fruiting occur at wet times, and the seed is disseminated by the wind. Storm winds have been observed to carry fruits to a distance of more than one kilometer.

Five species are known, 1 in Burma, Siam, and Indo-China, 2 in the Malay Peninsula, 3 in Sumatra, and 2 in the Philippines.

Key to Philippine species of Parashorea.

a^1. Leaves rather smooth and whitish beneath; fruit less than 2 cm in diameter ..... 1. *P. plicata.*

a^2. Leaves brownish pubescent or tomentose beneath; fruit more than 2 cm in diameter ..... 2. *P. warburgii.*

1. **PARASHOREA PLICATA** Brandis. **Apnit (Polillo, Tayabas, Catanduanes, Camarines, Albay, Sorsogon); bagtican (Occidental Negros, Davao); bayucan (Nueva Ecija, Laguna); binaliuan (Bulacan); danlig (Tayabas, Masbate, Occidental Negros); lauan (Nueva Ecija, Laguna, Rizal, Tayabas, Camarines, Sorsogon, Masbate, Capiz, Occidental Negros, Leyte, Samar, Surigao, Agusan, Davao, Zamboanga); malaanonang (Laguna); mayapis (Polillo); tacuban (Camarines).**

Parashorea plicata Brandis, Journ. Linn. Soc. Bot. 31 (1895) 104; Merr. & Rolfe, Philip. Journ. Sci. § C 3 (1908) 114; Foxworthy, Philip. Journ. Sci. § C 6 (1911) 280; § C 13 (1918) 194; Whitford, Philip. Bur. For. Bull. 10[3] (1911) 64, *pls. 60, 61.*

Parashorea malaanonan Merrill, Sp. Blancoanae (1918) 271; Enum. Philip. Fl. Pl. 3 (1923) 100, *excl. syn.;* Van Slooten, Bull. Jard. Bot. Buitenz. III 8 (1927) 373; Univ. Calif. Publ. Bot. 15 (1929) 202; Reyes, Philip. Journ. Sci. 22 (1923) 330, *pls. 6–8, 22.*

Branchlets dark when dry, glabrous or with scattered stellate hairs. Stipules deciduous, semiamplexicaul, leaving annular scars. Leaves elliptic to ovate, 6 to 15 cm long, 5 to 8 cm wide, glabrous, shiny dark green above, whitish beneath; secondary nerves 7 to 10 pairs, with a distinct fold between them, similar to that in *Dipterocarpus;* petioles 1.5 to 2 cm long, grayish pubescent. In terminal bud young leaves completely enclosed within stipules. Inflorescences branched, 12 to 15 cm long, branches few-flowered, gray tomentose. Flowers large, up to 2.5 cm in diameter, white or yellowish, rather fragrant, on thick tomentose pedicels half length of sepals. Sepals equal, lanceolate, acute, 7 to 8 mm long, 3 mm wide at base, grayish tomentose outside, pubescent inside. Petals ovate, 1.5 to 2 cm long, about 1 cm wide, pubescent or tomentose on part exposed in bud, pubescent or glabrous inside, many-nerved. Stamens 15, in two

whorls; filaments ovate or ovate oblong, abruptly attenuate, 1 to 2 mm long, up to 1 mm wide at base; anthers linear, glabrous, cells nearly equal, two posterior cells bluntly apiculate, 2 to 2.5 mm long; appendage of connective 4 to 5 mm long, thick, spindle-shaped, with a long point. Ovary half immersed in broad obconical receptacle, narrowed into a 2 mm long hairy stylopodium; style longer than stylopodium, upper half glabrous; stigma minute, flat. Fruit with 5 long wings, 8 to 15 cm long, wings narrowed below, not enclosing fruit. Nut nearly globose. tomentose, 1.5 to 2.75 cm high, about the same diameter, crowned by persistent stylopodium.

Vidal 76, 990, 2033 (*type*).

Merrill [62] has, I think, a mistaken view of the identity of Blanco's *Mocanera malaanonan* and *Dipterocarpus malaanonan*, which seem to belong to *Shorea malaanonan* Bl.=*S. polita* Vid.[63] The name "malaanonan" is commonly used for several of the species producing lauan, but it is rarely used for *Parashorea*.

This species is also known from Borneo.

Distribution in the Philippines:

LUZON, Nueva Ecija, Bulacan, Rizal, Laguna, Tayabas, Camarines, Albay, and Sorsogon Provinces. POLILLO. CATANDUANES. MASBATE. PANAY, Capiz Province. NEGROS, Occidental Negros Province. LEYTE. SAMAR. BILIRAN. MINDANAO, Surigao, Agusan, Bukidnon, Davao, and Zamboanga Provinces.

The name "bagtican" has come into common use because it was the name used locally in Occidental Negros Province, where the species was first exploited commercially on a large scale.

2. PARASHOREA WARBURGII Brandis. Apnit, danlig, lauan pula (Tayabas); lauaan, bagtican (Agusan).

Parashorea Warburgii BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 105; FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 1954; Philip. Journ. Sci. § C 13 (1918) 184; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 100.

Brandis says:

Only fruit known, which, however, undoubtedly belongs to this genus. Fruit on a thick obconical pedicel ¼ in. long, globose, ¾ in. diam., tomentose, with the remains of a slender tomentose stylopodium ⅛ in. long. The three larger wings of fruiting-calyx up to 5 in. long. and ¾ in. broad; the two smaller segments narrower and ⅜–½ the length of the larger segments. Longitudinal nerves of the larger segments 8–10. Pericarp thin, crustaceous. Cotyledons equal, bifid to base, the 4 lobes prismatic with 2 flat and 1 rounded face. Radicle half the length of embryo. Cells of cotyledons closely packed with minute starch-grains.

[62] Sp. Blancoanae (1918) 271. [63] Op. cit., p. 271.

I, formerly,[64] considered this form a synonym of *P. plicata.* Examination of the material at the British Museum and material collected by Elmer in Agusan convinced me that it was a distinct species. The young twigs and the under side of the leaves are densely brown pubescent or tomentose and soft to the touch. This covering causes the leaves to appear brownish below, instead of whitish, as in *P. plicata.* Van Slooten and Merrill have expressed doubt as to the distinctness of the two species.

MINDANAO, plain forest of Dagatpan, *Warburg, s. n.* (*type*).

Distribution:

LUZON, Tayabas Province, *For. Bur. 6047 Kobbe; For. Bur. 10221 Curran; For. Bur. 29347 Labaco and Masias.* All of these are sterile. MINDANAO, Agusan Province, Cabadbaran, *Elmer 14066, For Bur. 27471 Demesa.* The latter is included on Merrill's authority.[65] BRITISH NORTH BORNEO, *Foxworthy 568.*

8. Genus VATICA Linnæus

Small to large trees, usually of more scattered occurrence than is the case with members of other genera of this family. The bark is usually light-colored, thin, and not deeply longitudinally fissured. It is often very shallowly wrinkled when dry. The inner bark is usually yellow or brownish. .

The most complete account of the botanical characteristics of the genus has been given by Van Slooten [66] and the following, with only very slight change, is taken from his account. Stipules nearly always small, never semiamplexicaul, early deciduous; scars of stipules never annular. Leaves as a rule coriaceous, entire, flat; lateral nerves limited in number, always distinct, though sometimes hardly prominent, curved near margin but not forming an intramarginal nerve, often alternating with more or less distinct intermediate nerves; venation reticulate. Inflorescences terminal and axillary, forming one single large, many-flowered panicle or arranged along branches. Flowers often white, very fragrant. Calyx tube very short; lobes imbricate, afterwards pseudo-valvate, equal in length or distinctly unequal and then the larger lobes obtuse, the 3 shorter ones acute. Petals imbricate, at their tops more or less distinctly contorted in bud, overlapping either to right or to left, many-nerved, minutely pubescent on half of outer surface which is

[64] Philip. Journ. Sci. § C 6 (1911) 280.
[65] Enum. Philip. Fl. Pl. 3 (1923) 101.
[66] Bull. Jard. Bot. Buitenz. III 9 (1927) 67.

external in bud. Stamens 15, of which 10 are episepalous, placed in 5 radical pairs, all stamens very short, glabrous, subcoherent at base; filaments triangular, very rarely gradually passing into a filiform upper portion, inwardly increasing in length; anther cells short, usually very unequal, margins always glabrous; connectives produced into a thick, conical, never filiform, obtuse or subacute point shorter than anther cells. Ovary inserted with a broad base, free or partly immersed in calyx tube, generally semiglobose or rounded-conical, densely and minutely stellate-tomentose, without stylopodium, thick-walled, 3-celled; style short, usually furrowed and ribbed, entirely glabrous or pubescent at base, crowned by a small cup containing 3-lobed stigma; lobes obtuse or acute, then converging, stigma capitate or acutely conical. Fruiting calyx developed in different ways: (*a*) segments unequal, all growing out but only two expanding into long wings (subgenus *Synaptea*) nut adnate to the calyx tube either with its very base only or for nearly half its length; (*b*) segments equal, all enlarged though often but little, adnate to very base of fruit either with bases only or entirely, in the first case loosely enclosing fruit or spreading or reflexed, in the second case forming one level more or less flat or 5 woody tubercles (subgenus *Isauxis*, incl. subgenus *Retinodendron;* (*c*) segments equally though slightly enlarged or falling off, but calyx tube much enlarged, thickened into a cup nearly entirely surrounding nut or a considerable part of it (subgenus *Pachynocarpus*).

A genus of some 60 species, found throughout most of the range of the family. The center of distribution seems to be in the Malayan region. Borneo is credited with 19 species, the Malay Peniusula with 17 and Sumatra with 9.

Most species are recorded as occurring at low elevations, but *V. Whitfordii* is said to occur at altitudes up to 800 m and *V. mindanensis* at altitudes up to 1100 m. Certain forms are found on low coastal hills, or even down to the edge of the beach.

Products.—Wood not abundant, but well regarded. A good description of the wood is given by Reyes.[67]

Wood oil, a considerable amount, sticky, resembling balao, is found in certain species in the freshly cut wood. No commercial use is made of this product.

Resin is present in all species, but usually in small amounts and not used commercially in the Philippines.

[67] Philip. Journ. Sci. 22 (1923) 319.

Growth studies have not been made of the Philippine species, and growth is believed to be rather slow.

Key to the Philippine species of Vatica.

a^1. Fruiting calyx with 2 long wings that are much longer than the 3 others. § 1. *Synaptea.*
  b^1. Leaves obtusely rounded at both ends..... 3. *V. obtusifolia.*
  b^2. Leaves acute or acuminate at apex.
    c^1. Stigma distinctly lobed, not glandular.
      d^1. Calyx segments unequal in flower..... 1. *V. mangachapoi.*
      d^2. Calyx segments equal in flower..... 2. *V. Whitfordii.*
    c^2. Stigma capitate and glandular or obscurely lobed.
      d^1. Branchlets ferruginous furfuraceous..... 4. *V. pachyphylla.*
      d^2. Branchlets glabrous or nearly so.
        e^1. Secondary nerves about 7..... 5. *V. Blancoana.*
        e^2. Secondary nerves 11 to 14 pairs..... 6. *V. mindanensis.*
a^2. Fruiting calyx without long wings; calyx segments equal, usually shorter than fruit, bases only or entirely adnate to very base of fruit. § 2. *Isauxis.*
  b^1. Leaves 24 to 46 cm long; fruit 4 to 6 cm long..... 7. *V. papuana.*
  b^2. Leaves 5 to 13.5 cm long; fruit less than 1 cm long.... 8. *V. elliptica.*

1. VATICA MANGACHAPOI Blanco. Narig, karig.

Vatica mangachapoi Blanco, Fl. Filip. (1837) 401; Foxworthy, Philip. Journ. Sci. § C 6 (1911) 282; § C 13 (1918) 196; Merrill, Sp. Blancoanae (1918) 272; Enum. Philip. Fl. Pl. 3 (1923) 101; Reyes, Philip. Journ. Sci. 22 (1923) 320, *pl. 10;* Van Slooten, Bull. Jard. Bot. Buitenz. III 9 (1927) 94.

Trees usually of medium size, though specimens up to 35 m high and 70 cm in diameter have been recorded. Bark light gray, rather smooth. Wood hard, heavy, brown, fine-grained. All parts glabrous except inflorescence and young shoots, which are covered with a stellate tomentum. Stipules small, caducous. Leaves pale on both sides, drying pale, coriaceous, lanceolate to elliptic, 7.5 to 12.5 cm long, 3 to 8 cm wide; petiole about 1 cm long (small leaves on flowering branches may be as little as 3 cm long and 15 mm wide, with petiole 6 to 7 mm long); secondary nerves 8 to 10 pairs, slightly prominent, tertiary nerves reticulate. Inflorescences terminal and axillary, pseudoterminal flowers frequent between main axis and a branch of panicle. Flowers white or cream-colored, very fragrant, 1 to 1.2 cm long, on pedicels nearly as long as calyx. Sepals in flower more or less unequal, two longer than others, on both sides with gray stellate pubescence. Petals white or cream-colored, linear-oblong, obtuse, hairy outside, 10 to 12 mm long, 1 to 3 mm wide. Stamens 15, 5 interior stamens on filaments longer than anthers.

10 outer stamens on very short filaments; prolongation of connective short, conical. Ovary more or less immersed in receptacle, tomentose with stellate hairs; style glabrous, 5-ribbed; stigma of 5 conical lobes. Fruit about 4 mm in diameter, free from calyx. Fruiting calyx with two long wings, 3.5 to 5 cm long, 12 to 18 mm wide, with about 5 principal longitudinal nerves; 3 shorter wings 10 to 18 mm long, 3 to 4 mm wide, with 3 or 4 principal longitudinal veins. Wings membranous or chartaceous.

There is no type material extant and Blanco's description leaves much to be desired. Merrill [68] indicates that he thinks the correctness of the reference of this form to Blanco's species doubtful, but this is the form to which the material has usually been referred; Merrill [69] has distributed illustrative material of it.

This tree is of scattered occurrence, in lowland or ridge forest, from sea level up to an altitude of 500 m. It has been known to occur down to the forest edge of the beach. It is very widely distributed in the Archipelago, from the Babuyanes Islands to Basilan, in seasonal and nonseasonal regions. It is also known from Sarawak and British North Borneo.

2. VATICA WHITFORDII Foxworthy sp. nov. § Synaptea. Plate 8.

Arbor mediocris. Folia elliptica, glaberrima, superne nitida, inferne opaca, acuta, petiolis tomentosis, nervi secundarii utrinque 8, nervis tertiariis reticulatis. Paniculae axillares et terminales pilis stellatis obtectae. Calycis segmenta triangularia ovata, extus pilis stellatis tecta. Petala lineari-oblonga, acuta, extus pubescente. Stamina 15, antherae brevae et latae. Ovarium a pilis stellatis tectum, stylo glabro, stigmate capitate. Fructus ovatus, sepalis 2 oblongis 3 cm longis, 3 lanceolatis 1 ad 2 cm longis.

Trees of medium size, up to 20 m tall and 40 cm in diameter. Young twigs ferruginous-tomentose. Leaves glabrous, 5 to 10 cm long, 2 to 5.5 cm wide, elliptic, blunt or subacute at apex, rounded or subcuneate at base, shiny above, dull beneath, secondary nerves about 8 pairs, tertiary nerves reticulate; petioles 8 to 12 mm long, ferruginous-tomentose or scurfy. Inflorescences terminal and axillary, 4 to 10 cm long, peduncle and pedicels ferruginous-tomentose, with stellate hairs. Flowers white,

[68] Sp. Blancoanae (1918) 272.
[69] Op. cit., no. 866.

on pedicels 1.5 to 2 mm long. Sepals triangular-ovate, tomentose outside, 2.5 to 3 mm long, 1.5 mm wide at base. Petals oblong-linear, acute at apex, 9 to 10 mm long, 1.5 to 2 mm wide, spreading in anthesis, overlapping in bud, with 10 to 12 longitudinal veins, pubescent outside, glabrous within. Stamens short, broad, about 0.5 mm long and wide, with short, acute projection of the connective. Ovary flattened hemispherical, 1.5 to 2 mm in diameter, 0.7 to 1 mm high, slightly sunken in receptacle, sometimes obscurely 5-ridged. Style columnar, about 0.7 mm long, slightly thickened at the top to hold the capitate or obscurely lobed stigma, stigma about 0.3 mm in diameter, 0.2 mm high. Fruit (described from *For. Bur. 1593*) with nut ovate, 0.6 mm in diameter, 0.8 mm high, sparsely covered with stellate hairs; 2 long wings oblong, 3 cm long, 7 to 8 mm wide, glabrous, with 5 principal longitudinal veins; 3 short wings broadly lanceolate, acute, 1 to 2 cm long, 6 to 8 mm wide, with 5 principal longitudinal veins.

LUZON, Bataan Province, Mount Mariveles, *Whitford 306* (type in the Philippine National Herbarium), May 21, 1904. Other specimens placed here are, *For. Bur. 804 Borden, Whitford 1224,* and *For. Bur. 27144 Udasco,* all in flower; *For. Bur. 1593 Borden and Merrill 3896,* in fruit. All of these were taken from the same locality. The only collection from another locality is *For. Bur. 21811 Maneja,* with immature fruit, collected in Pangasinan Province in 1914. No vernacular name has been recorded for the species.

All of the specimens listed here were formerly identified as *V. mangachapoi.* Mr. Symington, examining the collections in 1935, separated these out as probably a distinct species.

This species seems to be a ridge form, found at higher elevations than our other species of the genus. Collectors' notes indicate that it is found from 200 to 800 m above sea level. It is known only from the part of the Islands where there is a distinct dry season.

The species differs from *V. mangachapoi* in the smaller and differently shaped leaves, the equal calyx lobes in flower, the columnar style and capitate stigma, and the smaller fruit with short wings.

3. VATICA OBTUSIFOLIA Elmer.

Vatica obtusifolia ELMER, Leafl. Philip. Bot. 6 (1912) 1471; FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 196; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 102.

The species is known only from the original collection and the following original description:

A middle sized tree; stem 3 dm. in diam., terete straight, 12 m. high or higher, branched at the top only; wood hard, heavy, odorless and tasteless, the outer one third dingy white, the balance nearly avellaneous; the sap of the wood clear and somewhat viscid; main branches occasionally arising from near the middle but erect, numerously branched toward the ends; twigs very numerous, erect, forming dense bushes, glabrous, drying blackish brown. *Leaves* copious, alternate, elliptically oblong, the normal blades 5 cm. long, 2.5 cm. wide across the middle, frequently smaller, obtusely rounded at both ends, entire, flat, ascending, rigidly coriaceous, much paler or lighter green beneath, curing dull green, glabrate or minutely scurfy or finely pulverulent; petiole 1 cm. long, when young pulverulent, ultimately glabrous and finely verrucose; midvein brown in the dry state, prominent beneath, nearly glabrous in old leaves; lateral nerves 7 to 9 primary pairs, tips anastomosing, relatively faint, reticulations fine and quite conspicuous from both sides. *Inflorescence* paniculately racemose, terminal or from the uppermost leaf axils, strict, erect or ascending, less than 1 dm. long, frequently only 5 cm. long, branched from the middle or toward the distal end; branches few and short, only sparingly rebranched, finely scurfy or pulverulent as is also the strict peduncle; pedicel straight and slender, 5 mm. long or much less, ashy gray pulverulent; flowers faintly but sweetly fragrant, dirty yellowish green on the outer organs; calyx valvate, 5 mm. long, 3 mm. thick, erect and tubular in shape, green and covered with a yellowish gray pulverulence, united toward the base; the 5 segments 3 mm. long, narrowly oblong or ligulate, obtusely rounded at apex, 1.5 mm. wide, occasionally some of them are smaller in size, erect at first, ultimately reflexed; corolla in the bud state tubular, imbricate but straight or nearly so, 1.25 cm. long, 3 mm. thick; segments pure white, very finely puberulent on the outer exposed sides, glabrous on the ventral surface, obtusely rounded at both ends, strap-like or narrowly oblong, 4 mm. wide, the inner side subincurved and glabrous along the outer edge; stamens 15, in 2 series, upon short somewhat flattened and base expanded glabrous filaments, 5, inserted upon the inner basal portion of the 5 petals, the balance in pairs of one above the other, inserted upon the basal portion of the calyx surrounding the ovary, the upper ones upon filaments twice as long as the lower ones; anthers oblong, 0.75 mm. long, all alike, the connective ending in a fine obtuse or mucronate point, somewhat flattened, ellipsoid from the side view, also glabrous; ovary one half immersed, the upper free portion conical and merely puberulent, toward the base distinctly 5-rugose, with 3 large ovules; style and stigma 1.5 mm. long, strict, the latter somewhat thickened or capitate.

PALAWAN, Puerto Princesa, Mount Pulgar, *Elmer 12963*, April, 1911. Discovered in dry stony wooded flat at 250 feet altitude. Rare. (Isotype in the Philippine National Herbarium.)

This species is very distinct from other Philippine species by the small, obtuse leaves.

4. VATICA PACHYPHYLLA Merrill. **Hagakhac na itim, dadiangao, tamahnan (Camarines); manapo (Tayabas); yacal (Polillo); banic (Cagayan).**

Vatica pachyphylla MERRILL, Philip. Journ. Sci. § C 13 (1918) 311; Enum. Philip. Fl. Pl. 3 (1923) 102.

A tree reaching a height of 30 m and a diameter of 60 cm, glabrous except younger parts. Branches terete, brownish, wrinkled when dry, about 5 mm in diameter, glabrous or nearly so, branchlets densely ferruginous-furfuraceous. Leaves thickly coriaceous, elliptic to oblong-elliptic, 11 to 14 cm long, 5 to 8 cm wide, apex rather prominently acuminate, base acute to rounded, when dry olivaceous, shiny, very young leaves more or less stellate-puberulent, indumentum caducous, leaves soon entirely glabrous; lateral nerves about 12 on each side of midrib, prominent, curved, reticulations not conspicuous; petioles 1.5 to 2 cm long, when young densely and minutely furfuraceous, in age glabrous or nearly so. Inflorescences terminal, pyramidal, up to 18 cm long, lower branches up to 9 cm long, all parts densely stellate-furfuraceous, indumentum usually lemon-yellow, on younger parts shading to pale gray. Flowers numerous. Sepals oblong, obtuse, about 4 mm long and 1 to 1.5 mm wide, densely pale gray puberulent. Stamens 15, anthers less than 1 mm long. Ovary subglobose, glabrous; style 0.7 mm long or less, glabrous; stigma subcapitate, very obscurely 3-lobed.

LUZON, Camarines Norte Province, Paracale, *For. Bur. 27102 Alhambra* (type in the Philippine National Herbarium), March 12, 1918, in dipterocarp forest of the tanguile-lauan type.

This species is well characterized by its elliptic, thickly coriaceous leaves, by which it is readily distinguished from the other Philippine forms of the genus. The ferruginous indumentum of the young branchlets and the lemon-yellow to pale-gray indumentum of the inflorescences are characteristic.

The fruit was not known when the original description was prepared. Since then, fruiting material has been received and is described from *For. Bur. 27825 Alhambra*, collected at Mambulao, Camarines, October 18, 1919. The fruit is subglobose and stellate-pubescent, with persistent style and stigma, 8 mm high and about the same diameter. The two long wings are oblong to oblanceolate, rounded at the top, 5 to 7 cm long, 14 to 20 mm wide, with 5 to 7 principal longitudinal nerves. The three short wings are ovate-lanceolate, acute, 1 to 2 cm long and 5 to 8 mm wide, with 5 to 7 principal nerves.

The tree is of scattered occurrence from near sea level up to an altitude of about 250 m. The wood is said to be of good quality and quite durable. It is said to be used for house posts, flooring, and for the keels of bancas.

Distribution.—LUZON, Cagayan, Tayabas, and Camarines Provinces. POLILLO. This species has been found only in the nonseasonal part of the Islands.

5. VATICA BLANCOANA Elmer.

Vatica Blancoana ELMER, Leafl. Philip. Bot. 4 (1912) 1473; FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 196; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 102.

Original description:

A small slender tree or shrub-like; stem 2 dm. thick, 8 m. high, branched from the middle or toward the top only; wood moderately hard, bitter, odorless, dingy or yellowish white; bark of the same color except the smoothish gray surface, rather easily separating from the wood; branches few and freely rebranched, relatively short. *Leaves* subchartaceous, alternatingly scattered, flat, horizontal or descending, slightly paler green beneath, curing brown, glabrous, entire, the bluntly or acute to acuminate apex somewhat recurved, base obtuse, oblong, the larger blades 15 cm. long, one-third as wide across the middle; petiole subterete, stout, also glabrous, 1 to 1.5 cm. long; midvein very bold beneath, smooth and brown in the dry state; lateral nerves about 7 on a side, ascending, tips strongly curved but scarcely united, also prominent, reticulations very fine and equally visible from both sides. *Inflorescence* mostly terminal or from the uppermost leaf axils, suberect or laterally spreading, paniculately branched from the base, 1 dm. long and nearly as wide; main stalks flexible, sparsely pulverulent, alternatingly rebranched, reddish brown when fresh, the ultimate ones divaricate and subdichotomous; pedicels grayish puberulent, strict, less than 3 mm. long; *flowers* arranged in all directions, sweetly fragrant; *calyx* green, campanulate or cup shaped, 2 mm. long and nearly as thick, united toward the base, very densely grayish green puberulent, usually latericius gland dotted on the outside, adnate, the 5 segments sharply acute, straight even in anthesis; *corolla* in bud yellow, 1.25 cm. long, 4 mm. thick, tubular, strongly imbricate and twisted to the left especially toward the blunt apex, similarly cinereous puberulent on the outer exposed sides, 1.5 cm. long, 4 mm. wide, narrowly oblong or oblanceolate ligulate, apex roundly obtuse, in anthesis strongly reflexed or spreading and usually twisted, cremeus; *stamens* 15, composed of an alternating single with a double series, inserted upon the basal portion of the calyx surrounding the ovary; filaments short, flattened, expanded at the base, glabrous, that of the outer double series only one half as long; anther yellow, flattened, oblongish, 0.75 mm. long, the connective faintly apiculate; the free upper one half of the ovary conically pointed and finely puberulent, toward the base rugulose by the impression of the double stamens; style strict, glabrous, 1.5 mm. long; stigma capitate, apparently glandular.

The tree is of scattered occurrence from near sea level up to *13123* (type; isotypes in Philippine National Herbarium); also *Elmer 12754* from same locality.

The species is known only from the original collections.

6. VATICA MINDANENSIS Foxworthy. **Bagansusu (Misamis); mangisic (Bukidnon); narig (Lanao); saongsaoñgan (Leyte); binuñgo, liloan, malabagobo, sañganan (Agusan).**

Vatica mindanensis FOXWORTHY, Leafl. Philip. Bot. 6 (1913) 1957; Philip. Journ. Sci. § C 13 (1918) 196; MERRILL, Enum. Philip. Fl. Pl. 3 (1923) 102; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 9 (1927) 71.

V. sorsogonensis FOXWORTHY, Philip. Journ. Sci. § C 13 (1918) 196.

A tree 12 m high, 60 cm in diameter. Young branchlets, twigs, petioles, and parts of midrib beneath covered with scattered, fine, tufted, peltate scales. Leaves very thinly coriaceous or chartaceous, glabrous except along nerves, dark green above, much lighter beneath, lanceolate or elliptic-lanceolate, long-acuminate at apex, rounded or subcuneate at base, 5 to 15.5 cm long, 2 to 5.3 cm broad; secondary nerves 11 to 14 pairs, curved, ascending, sometimes anastomosing near margin, tertiary nerves prominent on both surfaces, forming a reticulate pattern; petioles 15 to 22 mm long. Inflorescences paniculate, axillary or subterminal, 2 to 4 cm long. Flowers 1 to 1.5 cm long, white or cream-colored, fragrant. Sepals thick, coriaceous, 2.5 to 3 mm long, 1.3 mm wide, almost triangular, densely gray tomentose. Petals broadly oblong, densely tomentose without and within, about 10 mm long and 6 mm wide, with indications of 7 or 8 principal longitudinal veins. Stamens 15, arranged in groups, 1.5 mm long, 0.4 mm wide; filaments thick and broad at base, tapering to about 0.3 mm wide below anthers, total length of filament about 0.8 mm; anthers ellipsoid, inner pair shorter than outer, 0.2 to 0.3 mm long; connective blunt-conical, projecting beyond anthers for about 0.1 mm. Ovary hemispherical, partly immersed in receptacle, about 1.7 mm long, 2 mm in diameter; densely gray tomentose, with indication of division into 3 lobes; style tapering, cylindric, about 2 mm long, surmounted by capitate or obscurely 3-lobed stigma, stigma apparently glandular. Fruit gray tomentose, ovoid, 4 to 5 mm tall, sometimes with persistent style, the 2 long wings oblanceolate or oblong, 3.5 to 4.5 cm long, 9 to 11 mm wide, with 5 principal longitudinal veins; the 3 short wings lanceolate, 6 to 10 mm long, 1 to 2.5 mm wide, with pubescence so dense as to obscure longitudinal veins.

MINDANAO, Agusan Province, Mount Urdaneta, Cabadbaran, *Elmer 13680* (type in the Philippine National Herbarium), September, 1912, *Elmer 13359, 13398*, July, 1912. LUZON, Sorsogon Province, Irosin, *Elmer 16840* (type of *V. sorsogonensis* Foxw. in the Philippine National Herbarium), August, 1916.

The wood is said to be of very good quality and quite durable.

Merrill [70] has reduced my *V. sorsogonensis* to this species and I believe that he is correct in so doing. The species differs from *V. mangachapoi* in its less coriaceous, more pointed leaves, its equal calyx lobes, and its stigmas, and from *V. blancoana* in the greater number of nerves in the leaves. It is rather widely distributed and of scattered occurrence in the parts of the Islands which have a nonseasonal climate, at elevations of from 300 to 1,100 m. Endemic.

Distribution.—LUZON, Rizal, Laguna, Tayabas, Camarines, and Sorsogon Provinces. LEYTE. MINDANAO, Agusan, Bukidnon, Misamis, Lanao, and Zamboanga Provinces.

7. **VATICA PAPUANA** Dyer.

Vatica papuana DYER, Journ. Bot. 16 (1878) 100; BRANDIS, Journ. Linn. Soc. Bot. 31 (1895) 127; MERRILL, Philip. Journ. Sci. 30 (1926) 411; VAN SLOOTEN, Bull. Jard. Bot. Buitenz. III 9 (1927) 112, *pl. 73, fig. 1.*

V. moluccana BURCK., Ann. Jard. Bot. Buitenz. 6 (1887) 226, *t. 26.*

V. schumanniana GILG in Engl. Bot. Jahrb. 18 Beibl. (1894) 45, 98.

Described by Van Slooten as follows:

Buds, young *shoots*, and *petioles* of young leaves coloured brownish by a dense indumentum of small stellately tufted hairs; young shoots compressed, angular by elevated ribs decurrent between the points of insertion of 2 succeeding leaves. *Stipules* oblong-lanceolate, acute, sessile with a wide, rounded base, many-nerved, the inner side slightly puberulous, up to 2 cm. long and 6–7 mm. wide. *Leaves* oblong, oblong-lanceolate or (ob)ovate-lanceolate, floral leaves often ovate, 24–46 cm. long, 8–16 cm. wide, rounded or subcordate at the base, slightly tapering towards the rounded top or attenuate and narrowed—sometimes abruptly so—into a blunt or sharp acumen up to 2½ cm. long, the upper surface shining, usually greyish when dry, glabrous or the lower part of the midrib very slightly, stellulately hairy, the lower surface dull, light brown or greyish green when dry, sprinkled throughout with shining minute stellate hairs especially on the strongly prominent midrib, very rarely becoming glabrous, with 15–20 pairs of prominent lateral nerves, tertiary nerves and veinlets reticulate and slightly prominent; *petioles* robust, comparatively short, 2–3 cm. long. *Inflorescences* terminal and in the axils of the higher leaves, together forming a single large, widely spreading, many-flowered panicle up to 25 cm.

[70] Loc. cit.

long, with large floral leaves, the partial panicles up to 20 cm. long, whether or not longer than the floral leaves, branching from the base; the axes compressed or angular, coloured light brown or greyish brown by an indumentum of minute stellate hairs as are the pedicels; the latter 2–4 mm. long, articulate; flowers rather varying in size. *Calyx*-tube ± 1 mm. long, calyx-lobes during the anthesis erect, afterwards slightly converging with recurved tops, equal in size or nearly so, ovate-oblong, 3 mm. long, at the base 1½ mm. wide, attenuate in the upper half towards the acute top, densely greyish brown tomentose on the outside, the inner side minutely puberulous. *Petals* obovate-oblong, 12–18 mm. long, 5–8 mm. wide, the inner side glabrous. *Stamens* 1¼–1¾ mm. long; filaments ½–¾ mm. long; anthers ¾–1 mm. long the very short, obtuse prolonged connective included. *Ovary* shorter than the style, rotundate-conical, ± 1 mm. high; style glabrous, 1½–2 mm. long, crowned by a capitate stigma consisting of broad and papillose lobes. Lobes of the *fruiting calyx* woody, quite reflexed, oblong-trigonous, the margins reflexed inward, 1¼–1½ cm. long, at the base up to 1 cm. wide, glabrous. *Nut* ovoid, acuminate, with 3 superficial furrows, densely and minutely granulate, 4–6 cm. long, 3–4 cm. wide, pericarp woody, up to 5 mm. thick.

The wood is said to be of good quality and the resin produced by the tree is sometimes used in the southern part of the range of the species.

A single collection (*Bur. Sci. 44349 Ramos & Edaño*, from Tawitawi) has been made in the Archipelago. The large fruits seem to be distributed by sea water. The species is recorded from East and South Borneo, the Moluccas, and New Guinea. This is the widest distribution of any Philippine species of *Vatica*.

8. VATICA ELLIPTICA Foxworthy sp. nov. § Isauxis. Plate 9.

Arbor mediocris. Folia coriacea, elliptica vel oblongo-lanceolata, glaberrima, superne nitida, inferne opaca, petiolis pubescentis vel tomentosis; nervi secundarii utrinque 8 ad 10 nervis intramarginalibus juncti, nervis intermediis multis brevioribus, nervis tertiariis reticulatis. Paniculae axillares pilis stellatis obtectae. Calycis segmenta triangularia, extus pilis stellatis tecta, intus pilosa. Petala oblonga, extus pilis stellatis tecta. Stamina 15. Ovarium a pilis stellatis tectum, stylo glabro, stigmate conico.

Small or medium-sized trees up to 15 m high and 30 cm in diameter. Young twigs densely ferruginous pubescent, with scattered stellate hairs. Leaves elliptic to oblong-lanceolate, shiny above and dull or lighter-colored beneath, acuminate at apex, point rounded, cuneate or acute at base, margins slightly inrolled, principal nerves about 8 to 10 pairs, anastomosing

toward margin into a rather indistinct intramarginal vein, tertiary nerves reticulate; leaf blade 5 to 13.5 cm long, 1.5 to 4.5 cm wide; petiole pubescent to tomentose, 1 to 1.5 cm long. Inflorescences axillary, lax, much-branched, 4 to 8 cm long. Flowers yellowish, on pedicels 3 to 5 mm long, pedicels scurfily tomentose with numerous stellate hairs. Sepals triangular, 1.5 to 2 mm long, 0.8 mm wide at base, with same kind of tomentum as pedicel. Petals oblong, blunt, about 5 mm long and 2 mm wide, pubescent outside, with 3 or 4 principal longitudinal veins. Stamens 0.6 mm long or less, about 0.3 mm wide; anther 0.4 mm long, 0.1 mm wide; appendix to connective rather pyramidal, not longer than anther. Ovary tomentose, about 1 mm in diameter, 0.8 mm high; style columnar, 0.5 mm long, glabrous, spreading at the top to hold the conical stigma, which is about 0.2 mm high and divided into trigonous converging lobes.

MINDANAO, Zamboanga Province, Mount Kaladis, *For. Bur. 24160 Miranda* (type in the Philippine National Herbarium), June, 1915. *For. Bur. 23838 Villamil*, with flowers and young fruit, was collected in the same district May 25, 1914. The young fruit is depressed-globose, obscurely 5-sulcate, covered with a ferruginous tomentum, 3 to 4 mm in diameter, about 2.5 mm high. The calyx lobes are not in evidence and have, presumably, fallen.

The tree is said to grow on ridges and low hills near the coast at an altitude of not more than 100 m above sea level.

This species is close to *V. pedicellata* Brandis [71] of Sarawak, from which it seems to differ by the smaller size of leaves, the shorter petals, and the columnar style. Mature fruit will be needed to make certain that the species are distinct.

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ILLUSTRATIONS

[Drawing of figures in Plate 3 by Ricardo C. Aguilar, illustrator of the Philippine National Herbarium; photographs by Bureau of Science.]

PLATE 1

Anisoptera aurea Foxw. *For. Bur. 28359 C. Mabesa.* Type in Phil. Nat. Herb.

PLATE 2

Anisoptera aurea Foxw. *For. Bur. 10700 H. M. Curran.* Fruit in Phil. Nat. Herb.

PLATE 3

Balanocarpus cagayanensis Foxw. *For. Bur. 19987 A. Bernardo.* Type in Phil. Nat. Herb., flowering specimen. *For. Bur. 20454 A. Bernardo.* Fig. *1*, flowering twig, × 0.05; *2*, mature fruit, × 2; *3*, flower, × 6; *4*, flower, with some petals and sepals removed, × 6; *5*, ovary, × 8; *6 and 7*, sepals, × 6; *8*, petal, × 6; *9*, stamen, × 16.

PLATE 4

Shorea gisok Foxw. *For. Bur. 25657 Gailipan.* Type in Phil. Nat. Herb.

PLATE 5

Shorea astylosa Foxw. *For Bur. 13271 Foxworthy, Demesa & Villamil.* Type in Phil. Nat. Herb.

PLATE 6

Shorea malibato Foxw. *Elmer 13525.* Type in Phil. Nat. Herb.

PLATE 7

Shorea almon Foxw. *For. Bur. 11647 H. N. Whitford.* Type in Phil. Nat. Herb.

PLATE 8

Vatica Whitfordii Foxw. *H. N. Whitford 306.* Type in Phil. Nat. Herb.

PLATE 9

Vatica elliptica Foxw. *For. Bur. 24160 D. P. Miranda.* Type in Phil. Nat. Herb.

PLATE 1. ANISOPTERA AUREA FOXW.

PLATE 2. ANISOPTERA AUREA FOXW.

PLATE 3. BALANOCARPUS CAGAYANENSIS FOXW.

PLATE 4. SHOREA GISOK FOXW.

PLATE 5. SHOREA ASTYLOSA FOXW.

PLATE 6. SHOREA MALIBATO FOXW.

PLATE 7. SHOREA ALMON FOXW.

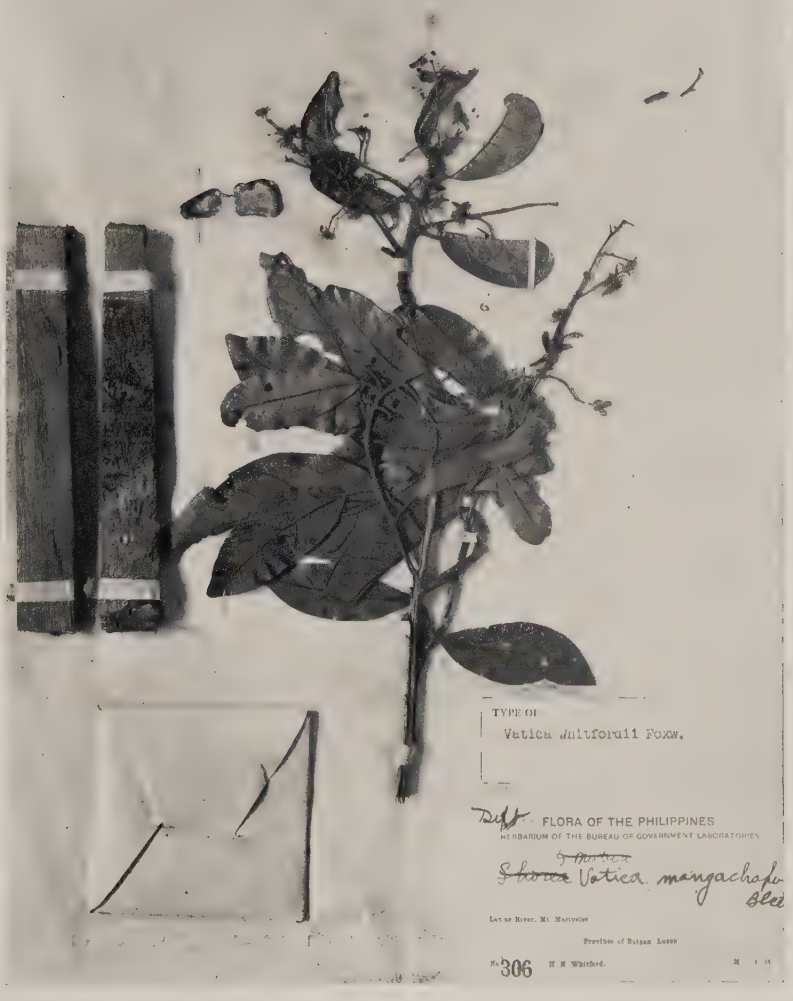

PLATE 8. VATICA WHITFORDII FOXW.

PLATE 9. VATICA ELLIPTICA FOXW.

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